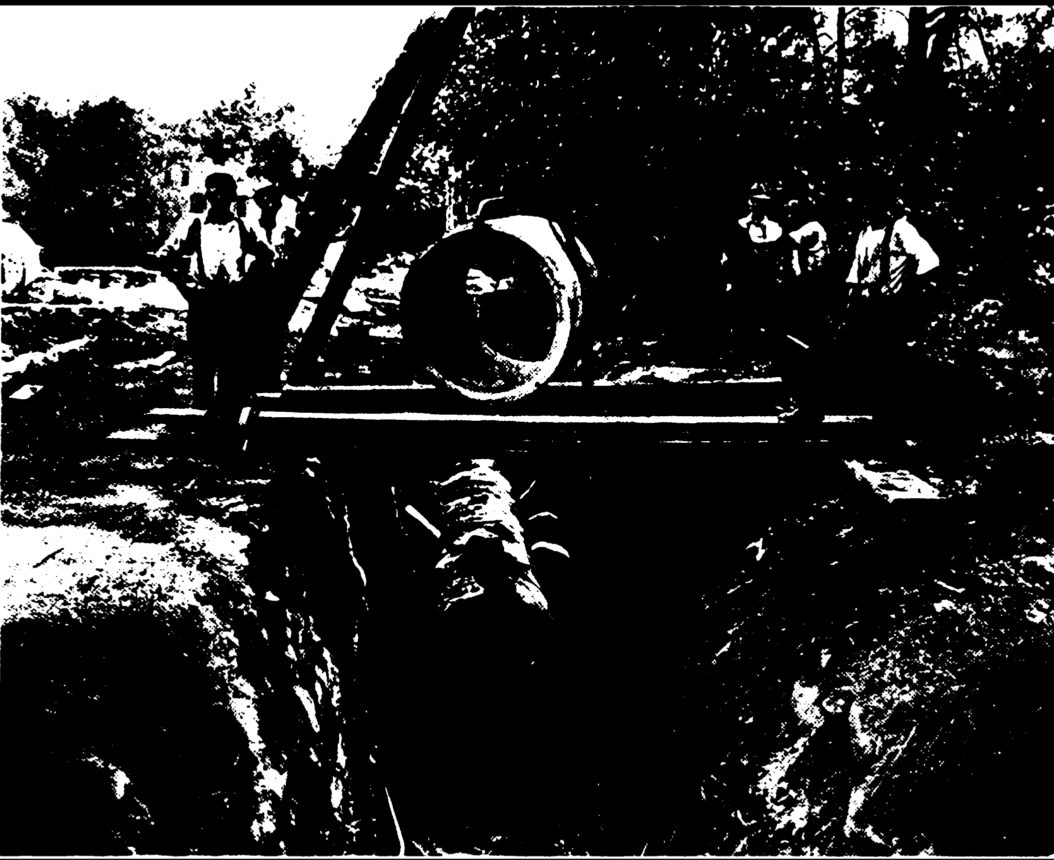

Proceedings ... Annual Convention.

American Society for Municipal Improvements, New York State Bankers Association

AT THE ATLANTIC CITY CONVENTION.

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PROCEEDINGS

OF THE

FIFTEENTH ANNUAL CONVENTION

OF THE

AMERICAN SOCIETY

OF

MUNICIPAL IMPROVEMENTS

HELD AT

ATLANTIC CITY, N. J., OCT. 20, 21, 22 and 23,

1908

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DISCUSSIONS.

REPORT OF COMMITTEE ON CITY GOVERNMENT AND LEGISLATION.

Chairman, Horace Andrews, Albany, N. Y.

The study of municipal government is rendered peculiarly difficult by constant change in the fundamental laws of our cities and by the enactment of general laws which affect the different municipal branches. It will be quite impossible to indicate the recent changes in the charters of all the cities in the United States. According to the federal census of 1900, there were 545 cities of over 8,000 population.

Some of the changes in the cities of New York state that have occurred within the past year have been investigated by this committee and will give a measure of those occurring throughout the whole country. The census of 1900 shows New York state as containing 9¾ per cent. of the whole population of the United States. It has 47 cities with populations of 8,000 or more.

Study of the acts of the legislature shows the dissatisfaction that exists everywhere with present conditions, for a large portion of the last session laws of New York state is devoted to new charters and charter amendments for the various cities. Perhaps this condition of chronic change is unavoidable, but it is a deplorable fact that only a few experts have familiarity with the laws of the cities in which they live. With officials constantly changing, new amendments to charters and ordi-

nances frequently being made and with only certain selected laws really enforced, it is little wonder that the ordinary citizen is densely ignorant of the laws that are supposed to control his well-being. Publicity, simplicity and stability would improve our laws and promote their efficiency.

The Lieutenant Governor of New York, himself a lawyer, presents the matter forcibly; he says: "We are governed too much. We hold that ignorance of the laws excuses no one; yet we add to the huge bulk of statutory enactment hundreds of new laws every year, many of them crude and ill-considered; some of them worse than useless, until it is difficult for even the trained lawyer to know the law."

The last legislature introduced bills designed to affect the government of all but five of the cities, with an aggregate population of but 81,410. There were 522 bills introduced, 130 of which became laws, affecting the remaining 42 cities. These 42 cities had an aggregate population in 1905 of 5,641,969, of which the City of New York contained 4,013,781. The legislation relating to New York City was relatively small in amount, only 178 of the bills and 22 of the 130 laws were devoted to its interests, although in general laws, not included in the above enumeration, New York City had 19 more, as the result of 276 bills introduced for its benefit. The student of municipal government has therefore to examine 149 new laws of the year 1908, if he wishes to inquire into the government of New York's cities.

Glens Falls, a very large village, which according to the 1905 census, had 14,650 inhabitants, received a city charter comprising 17 titles and 207 sections, covering 106 printed pages.

Oneonta, with 8,054 inhabitants, was also made a city; its charter has 16 titles and the numbers of its sections are as high as 263. It should be remarked, however, that this charter has to some extent followed the commendable example of that of the general charter of cities of the second class, and has left in each title—except the fourteenth and fifteenth—room for

expansion by future additions. For example, title 1 has sections 1 to 5; title 2, sections 10 to 22; title 3, sections 30 to 48, etc.

The City of Ithaca, which is very nearly the same in population as Glens Falls, has an entirely new charter of ten titles and 241 sections, covering 96 pages. Title 6 provides for a Department of Public Works with six Commissioners and the Mayor, who presides. One new Commissioner is to be appointed the first of each January, to serve for six years without compensation and to be ineligible for re-election until a year from the expiration of his term.

The City of Auburn, with 31,422 inhabitants, has an important charter amendment of 13 pages relating to public improvements and establishing a Health Department.

Binghamton, the largest city in southern central New York, with about 44,000 inhabitants at the present time, has four new laws, all of considerable importance to its government.

Buffalo had 48 bills introduced for its benefit, only 13 of which became laws. One of these adds four new sections to the charter. Under the Board of Park Commissioners, a forester is provided to care for the city's trees.

Fulton, a city of 8,847 population, has a general charter amendment of ten pages.

Mount Vernon, a city close to New York, which in 1905 had a population of 25,000, an increase of nearly 20 per cent. in five years, has nine new laws resulting from 31 bills introduced. One of these laws provides for a municipal cleaning of sidewalks from snow, ice, dirt, etc., in case the owner or occupant neglects to do this. The expense is not to exceed five cents per running foot of sidewalk and the cost becomes a lien on the land. In other places such laws have proved inoperative on account of the great number of small accounts and liens involved. A similar provision exists in the charter for cities of the second class.

The City of Rochester, with about 186,000 inhabitants at the present time, outgrew the rank of a city of the second class and last year received a separate charter. Five new laws were passed in 1908, however, affecting this charter.

The constitution of the State of New York which came into force in 1895, in its twelfth article, divides all cities in the state into three groups with an implied understanding that there shall be general laws relating to the cities of each class. New York, Buffalo and Rochester are the only cities of the first class. Rochester is, indeed, in no particular class at the present time. It is doubtful if any general charter will ever be enacted for this group of cities.

The second class cities, with populations of from 50,000 to 250,000, early became subjects of special inquiry regarding a uniform charter. A commission was appointed by the governor and public hearings were held in all the cities concerned. The charter proposed by this commission was submitted to the legislature, which altered it materially.

In its altered form it failed to become a law. It was further changed, and under Senator Horace White's management, was enacted in 1898. Under the White charter's provisions were included the cities of Rochester, Syracuse, Albany and Troy. At the 1905 convention of this Society, Mr. Thomas Neville of Rochester, presented a paper which treated of the operation of this "White" charter. The census of 1905 added Schenectady, Utica and Yonkers to the cities of the second class, and owing to some conflict of opinions relating to their laws, the uniform charter was re-cast, without material change in its provisions. This new charter is now the fundamental law of the six cities of the second class. This last charter, which went into effect last January, leaves the Chief of Police and the Chief of the Fire Department as holding office for indefinite terms, depending upon good behavior or permanent incapacity. The health officer was formerly included under similar provisions, but these are now set aside as regards his office. It is now provided that the City Engineer "shall devote his time exclusively to the

service of the city." Apparently this official is the only one singled out for such exclusive service; the requirements for eligibility are, however, not very high. This new uniform charter received seven amendments, or changes, since the first of last January. A bill increasing the salary of the City Engineer was vetoed, but a law was passed amending the general section relating to salaries, which provides methods for increasing or diminishing the salaries of the City Engineer and of the corporation counsel by action of the Board of Estimate and Apportionment, ratified by the Common Council. The section relating to the abandonment of unused streets was, with great propriety, repealed in 1908. A clerical error in Section 76 made "unexpended balances" read "unexpected balances," and seriously altered the intent of this section, necessitating its re-enactment with correct spelling.

In addition to the changes mentioned in the uniform charter, each of the six cities of the second class has had separate laws enacted by the last legislature. Thirty-one such acts in all were passed relating to the government of the six cities. The provisions of the former charters of the cities of the second class are still in effect where they do not conflict with those of the uniform charter.

Syracuse is exempt from the article of the uniform charter that provides for the other cities a Board of Education of three members, appointed by the Mayor for terms of six years, one new appointment being made every two years. Schenectady, by an act of the last legislature, is to have a board of education of five members, two to serve until March 1, 1909, and three until March 1, 1910; their terms of office to be two years thereafter. In the cities of the second class the commissioners of education serve without pay.

It is quite evident that there is a strong tendency to individuality among the cities. If they ever consent to be classed in groups and to have truly uniform laws at some future time, that time has not yet arrived and at present comparison between the governments of the various cities is rendered nearly

as difficult as it ever was, despite the so-called uniform charter of cities of the second class.

The changes in the charter of the City of New York would possibly have been larger in number if it had not been for the passage of a law which went into effect last April, providing for a commission of inquiry into the legal government of New York City. Said commission "may in its discretion, draft and submit with its final report a new charter." This final report is to be submitted to the legislature in 1909. It is evident that the methods of administering the government of the great City of New York do not meet with unqualified approval. The project of a new charter brings prominently into light the method of organizing the constructive branch of the municipal work and this is an appropriate theme for the discussion of this Society.

The end sought through the discussion is the development of the simplest and most business-like methods in promoting plans for municipal betterment, and after the adoption of plans, of carrying on the construction in an expeditious manner and with just as little "red tape" or formality as is possible. At the same time ample and permanent records and strict conformity to legal requirements must be secured. Can the best results be brought about by concentrating responsibility in a Board of Public Works, or with a single commissioner controlling all the various lines of municipal work, or can better work be done by having all departments under separate heads, reporting and responsible to the Mayor, whose multifarious duties prevent any but a perfunctory oversight of the municipal construction work—thus practically leaving the Commissions of Water Supply, of Sewerage, of Paving, of Public Buildings supreme in their various departments?

The suggestion of this theme for discussion came about through observing developments in the City of New York more particularly, although some of the other large cities seem a little inclined to adopt similar usage. The tendency at this time seems to be toward the employment of special commissions

in cases where a difficult situation presents itself as to water supply, sewerage, grade crossing or other works of magnitude, and this is true not only of New York, but of many other cities throughout the country. Very often it is well to have outside advice upon a difficult municipal problem, as presenting a view of the case which would not perhaps suggest itself to a public officer having daily familiarity with the matter under consideration, as well as to secure the agreement of independent designers of the same class of work. This, however, refers more to the examination and reports of a consulting engineer working in conjunction with the local engineer than to the "commission" idea, which places in the hands of a board, appointed for that special purpose only, some one great work which is later to be operated in conjunction with an already existing plant. The general tendency toward orderly proceeding in municipal affairs has led most cities in the past to concentrate constructive work in a committee of citizens, called a "Board of Public Works," or having some other title with similar meaning, and if this board carries on its work in a business-like way, there is little need for special commissions.

It seems to this committee that the same care exercised in the selection of a nearly permanent Board of Public Works, as has been shown in the selection of the membership of nearly all of these special commissions, would result in a higher class of construction, more uniform city regulations as to allowable constructions and a greater degree of economy for the city. The present time is generally regarded as an age of concentration of effort—of combinations of small plants operating in similar lines into one large organization, where under one head all the plants are operated presumably to better advantage as to production and distribution of product and at a saving of expense resulting from the substitution of one head for many, standardizing of product and other economies.

Much may be said in favor of this close organization where large interests are affected. In private business lines, manufacturing, etc., it seems to be the present day development from

a former condition when competition was said to be the life of trade, to a certain stability of trade conditions resulting from an absence of competition.

The above is observed in general private business—but as to the large municipal business there are indications of a rather marked departure from this concentration as is evidenced by the numerous special commissions which have within a comparatively few years been appointed to undertake works which are more or less special in their nature, but which would seem to fall properly within the scope of the various municipal departments and bureaus already established. The appointment of these special commissions has no doubt been brought about through the necessity of securing continuity of service over longer periods than the usual terms of political officers, in order to carry forward in an orderly and progressive manner some particularly great work without the delays incident to frequent changes in the executive head conducting the work when it might be delayed by such change and thereby inconvenience and annoy the municipality generally. These remarks are intended, not at all as an adverse criticism of the tendency noted, but as simply calling attention to a phase of present development along municipal lines which is of interest to the American Society of Municipal Improvements and which comes appropriately within our purview, it being our function to "promote the best methods to be employed in the management of municipal departments and in the construction of municipal works."

At this time we have in New York City the regularly organized departments in charge of the water supply, gas and electricity, sewerage, street paving, public buildings, docks, parks, etc., and in addition to the above and acting under special laws, the Board of Aqueduct Commissioners and the Board of Water Supply, acting independently of the department of water supply and of each other; also a Metropolitan Sewerage Commission independent of the sewer department, a Municipal Art Commission independent of all departments, but passing upon the esthetic features of all public constructions appearing

above ground within the city limits, and finally a State Commission called the "Public Service Commission," having supervision over the carrying corporations and of the companies supplying gas and electric light, heat and power, trenching somewhat on the ground of the department of water supply, gas and electricity, and falling heir to all of the powers of a former special commission having to do with the design and construction of subways.

While there have been many good reasons for the constituting of these various commissions, there seems to be no insuperable reason against the concentration of all the public works of New York City in a single commission or Board of Public Works, analogous to the London County Council. The London County Council has authority over most of the public works of a certain part of London, the division between the "city" and the "county" being somewhat complicated. This body seems originally to have been constituted to have particular authority over all matters relating to drainage and later to have been given supervision over nearly all of the municipal works. Many valuable reports have been issued by this body.

Some of the advantages which might be expected to result from such a concentration of municipal work would be a standardization of the work in similar lines over the entire city and a greater degree of co-operation among the various branches of the city work. The scientific observations, referred to a special commission, could just as well be instituted by the single Board of Public Works and the results published with the regular annual city reports.

The possibility of enforcing a proper sequence of work in a given locality would mean economy and convenience to the public. The concentration of authority would make impossible any tossing of responsibility from one department to another in cases of accident or dereliction in matters not unequivocally chargeable to one special department. The central authority would designate the branch of the general organization to rectify any defect, and this would make for less neglect of

duty where uncertainty as to responsibility might exist under the present methods. Among its special commissions New York City has many very able and public spirited citizens; it is, therefore, to be inferred that in the makeup of such a Board of Public Works as is suggested, the men capable of organizing and conducting such a body would be drawn from that same class of men.

For the purpose of securing comprehensive schemes of work and a sustained interest and initiative on the part of the members of such a nearly permanent body, the term of each member should be not less than five years and the personnel should change slowly, say by the appointment of one new commissioner each year as the term of one member expired.

In preparing this report no details of organization have been touched upon, but as giving valuable suggestions in this respect, attention is called to Mr. F. W. Cappelen's paper read before the Seventh Annual Convention of this Society, as to the different possibilities of administration and as regards the practice in many prominent cities throughout the world. Some of the possible advantages of a concentration of responsibility have been noted, but none of the disadvantages. It is the hope of this committee that discussion of the general subject will bring out much that may be urged on both sides as to the advantages and the disadvantages of the plan.

Does one large organization induce a lack of initiative through the absence of the rivalry of other departments? On the other hand, does the special commission idea conduce to the planning of unnecessary schemes of work which may be good in a general way, but more ornamental than useful?

With the concentrated organization are the public records apt to be better kept and more accessible for reference? Would the result be in the direction of economy? Would the variety of work in a great city cause a gradual reversion to bureaus pretty much as we know them now? The fact is that the actual work would be done by just about the same people who do it now and the change would be to one great organiza-

tion instead of, as now, many smaller organizations. Would the incentive for each man to do his best work be as great or greater, being part of a great organization, the head of which was nearly constant, or would the best work be done as we might say, on speculation, where a department head remained for only a limited time and quick advancement might be obtained by special activity?

Would control of all municipal work by one organization, necessarily acting through many bureaus, result in expediting the progressive steps in the design and construction of municipal works, or would the practical result be not greatly different from present experience?

It is hoped that the members generally will express themselves fully upon the above and any other questions which may be suggested during the discussion of how to promote the best methods in the management of municipal work.

REPORT OF COMMITTEE ON MUNICIPAL FRANCHISES.

Charles Carroll Brown, Chairman, Indianapolis, Ind.

The most promising development of recent years in respect to municipal franchises is to be found in the laws passed by several States placing the financial operations and the quality of service of public service industries under the supervision of State boards composed of competent men and served by experts in the various fields in which these industries are operated.

One of the principal difficulties in the past has been the ignorance of the ordinary municipal officials of the technical side of the operations of such companies and their neglect to apply the most common business principles to the formulation of franchises and contracts for service. It is practically impossible for any but the largest cities to expect expert service in these matters from the municipal officials and the assistance which experts employed for the purpose can render is often nullified by the action of politics or personal considerations.

The effect of the State board control on certain phases of the companies' activities is to overcome some of the disadvantages under which cities have been laboring on account of errors made in the granting of charters in past years, and when new contracts and charters are formulated the experience gained through contact with the State's experts and the advice obtainable from them will certainly have its effect upon the provisions in these instruments.

In the past most franchises have been given away and from some points of view and in many cases this has been an eminently proper mode of procedure. Where the mistake has been made is in making the contract indefinite or perpetual with insufficient provision for revision of any of its provisions, so that on the one hand the municipality suffers under changed conditions and on the other hand the company has cause for complaint. Unfortunately it is usually possible for the com-

pany to obtain relief from the city, but the company is seldom willing to relieve the city in case the contract turns out to be unfavorable to it. The value of the franchises which the city grants is discussed in one of the papers presented to this convention through this committee.

English cities, under the guidance in part of the Local Government Board, which is the central body supervising their operations, have inserted in franchises and contracts granted by them some valuable provisions, some of which have been included in the modern municipal franchise described in a paper presented herewith by a member of this committee. Such franchises as this one show progress in the terms of franchises and contracts, which is encouraging, even if it is slow.

Both the improvement in the terms of franchises and the control of operations under those granted recently and formerly promise amelioration of the existing conditions. The improvement in the States operating under laws providing for State supervision and in the cities in which the modern franchises are in use will soon begin to show itself sufficiently to induce extension of the same principles to other States. It is well to hasten slowly, for opinions differ as to the details of application of accepted principles, and even upon some of the principles, and a few years' experience is needed to weed out the unfit, and to show the effect of local conditions in modifying methods and results.

Especial emphasis seems desirable on the following points:

That city officials in smaller cities are not familiar with these subjects and do not realize the importance of a municipal franchise, and the benefits which the city should derive from it. Also the part that politics usually plays in matters of this kind. When the time comes that matters pertaining to municipal government are taken entirely out of politics, then we may expect to have better government, both municipal, State and national.

Also that too many perpetual franchises are given away with no provision for the future.

A MODERN MUNICIPAL FRANCHISE.

By Charles Carroll Brown, Indianapolis, Ind.

Whatever may be the success of efforts to control public service corporations through state boards or otherwise, the fact remains that the best results are obtained when it is made definitely to the interest of the company to give good service. Whatever will aid in producing this result will benefit the community, whether in actual cash received by the city treasury, or in reduced rates to consumers, or in satisfactory service.

The franchise granted to three persons representing commercial organizations in the City of Indianapolis in 1905, which has since been transferred to the Citizens' Gas Company, is such a franchise and its terms are worthy of study by companies proposing to start public service industries as well as by cities and companies proposing to make new contracts for service.

The origin of the franchise was in one for a company formed to supply Indianapolis with natural gas late in the '80's, in which Alfred F. Potts was one of the prime movers. Mr. Potts described the company and gave the principal provisions of the franchise in Municipal Engineering, vol. xiv, p. 182. The controlling feature in this company was the transfer by the stockholder in his subscription for stock of the entire control over his stock, except the receipt of dividends and the right to transfer the ownership to a named board of trustees, who elected directors, thus precluding the possibility of any competing company or hostile element securing control of the company. There were many other good features in the organization, most of which were transferred, together with the one described, to the franchise of the Citizens' Gas Company. The natural gas company was obliged to go out of business when the supply of natural gas was exhausted, the courts deciding that it had no power under its charter to enter other business,

such as the manufacture of gas. After long continued litigation, the natural gas company's mains within the city were sold to the new Citizens' Gas Company, organized to manufacture and sell artificial gas at a low price. Some of the provisions in English gas franchises were added to those carried over from the old company, and the result is described here as an indication of what can be done in making a public service corporation really a public servant at the same time that it gives adequate returns to its stockholders.

The company is now constructing a gas plant and is repairing the old mains, and at some time early in 1909 will be ready to furnish gas to its customers, many of whom are already on its lists for connection as soon as the gas is ready to deliver. The company points to the eminent success of the old natural gas company as evidence that its plan is good, and that success is accepted as evidence that the plan described is no experiment, but will demonstrate its satisfaction of all expectations.

The ordinance, approved August 30, 1905, approves a contract made by the Board of Public Works with Alfred F. Potts, Frank D. Stalnaker and Lorenz Schmidt, and certain fundamental terms of this contract, according to one of its provisions, are included in the state charter of the Citizens' Gas Company, to which the contract with the city was transferred by the three gentlemen named.

The charter broadly gives the company the power to supply Indianapolis and its inhabitants with light, heat and power.

The capital stock of $1,000,000 can be increased at any time by submitting the additional shares to sale at public auction on thirty days' published notice, any premium to go into surplus, and not to bear dividends. It is provided that if extensions of mains are desired, and they cannot be obtained under other paragraphs in the contract, the petitioners for extensions may subscribe for stock sufficient to lay the mains and sign contracts for gas sufficient to pay the interest on the cost, but even then the stock must be put up at auction and must be purchased at par by the petitioners in case it is not sold at a premium at the auction.

These provisions insure that the stock shall always bring its par value into the treasury, and that the dividends paid shall be on this par value, no more and no less. The necessary extensions are also provided for without overburdening the company, while at the same time giving the property owners large interest on the money invested in the extensions and ultimate return of the principal as well.

The capital stock, by the terms of the subscriptions, therefore, under one section of the contract, is placed in the control of a board of five trustees, stockholders, and must be voted as a whole. This Board of Trustees was named in the articles of incorporation, and the Board fills all vacancies, except that one member was nominated by the Mayor of the city, and a vacancy in this particular office is filled by another nomination by the Mayor. Failure of the Board of Trustees to fill a vacancy gives any stockholder the right to petition the Circuit Court to make the appointment, which it must do if the Board fails to act during ten days.

This provision keeps the company in the control of the Trustees, even if the stock is all bought up by a competing company. The original Board is one in which the people have the fullest confidence. The old gas company stock was largely bought by a hostile interest, but the Board of Trustees retained the control and operated the company for the public's benefit until it was wound up by the courts, although the hostile interest did everything possible to secure the property of the company, and prevent its devotion to the best interests of the public, which was the real owner of the company, all the original investments in stock having been repaid with eight per cent. interest. The Board of Trustees of the new company is expected to be equally steadfast in carrying out the original purposes of the founders of the company and the investors in its stock.

Any member of the Board of Trustees can be removed by the Circuit Court on showing that he is an employe or a holder of stock or other securities of any company delivering or pur-

posing to deliver gas in the city, or for corrupt practice or misconduct detrimental to the company's interest.

The Board of nine directors is elected each year by the Board of Trustees, to manage the business and prudential concerns of the company. This relieves the Board of Trustees of all duties, except that of securing competent directors independent of any influence detrimental to the company, and makes it possible to enlist as trustees men of the highest class and possessing the fullest confidence of the citizens and stockholders, without the opportunity to refuse on account of pressure of business or temporary condition of health.

The stock issued is entitled to cumulative annual dividends of ten per cent., payable semi-annually. The earnings of the company are devoted first to the payment of matured debts and operating expenses; second, to the payment of the dividends semi-annually and unpaid accrued dividends; third, to the extensions and betterments ordered by the Board of Public Works; and fourth, to repayments of stock subscriptions, thus reducing the capital upon which ten per cent. dividends must be paid. When the stockholders have been repaid their entire subscriptions with ten per cent. interest, the stock is cancelled and ownership by the company ceases, and it is wound up.

The old company had the same provisions in its franchise, except that the dividends paid were eight per cent., and the ownership on repayment of stock subscriptions did not pass to the city. The old company paid back all its stockholders and had property valued at a half million or more when it was wound up. Its franchise provided that in this event gas would be furnished at cost, but almost simultaneously with the complete repayment, natural gas gave out, and the company was deemed by the courts unable to manufacture gas. An attempt was made to declare the property of the company, particularly a good system of mains in first class condition, public property, to be transferred to the new company to be formed with power to manufacture as well as distribute gas. The courts decided, however, that the property belonging to the stockholders, not-

withstanding their stock had been fully repaid, so the property was sold to the new company at an appraised valuation under the city's option to purchase, and the stockholders receive a large additional dividend after dividends equal to the original investment, plus eight per cent. interest, at the same time that the new company obtained a distribution system at a fraction of the cost of a new system. The ultimate ownership question is settled in the new company's franchise by transferring the property to the city when the stockholders are fully paid.

The state charter fixes the life of the company at fifty years, and the contract with the city is for twenty-five years. If the stockholders are not all repaid in twenty-five years, the Board of Public Works may require the company to bond itself at six per cent. for the amounts due the stockholders, pay them off, and then transfer the property to the city, subject to all indebtedness, including these bonds, or may pay the amount due the stockholders itself and thus secure the property. In case the company becomes insolvent, the city can acquire the property by paying or assuming the company's debts, including that due to stockholders for still unpaid subscriptions.

The company is required to make semi-annual detailed statements of its affairs, including assets and liabilities, disbursements and receipts, and publish them in two newspapers. The city controller can investigate the books, to check the reports or otherwise, and the city engineer can examine the plant at any time.

The gas furnished must have at least 600 British thermal units per cubic foot, and the price must not exceed sixty cents per 1,000 cubic feet.

There are the usual provisions protecting the city and citizens during construction, giving rights of way, insuring compliance with the terms of the franchise, etc.

There was some discussion of the propriety of inserting one common English provision, whereby an increase in allowable dividend rate would accompany a reduction in price, but this was finally dropped; the English companies continuing in business, while this company may be wound up in twenty-five years.

North Eighteenth street, looking from Eaton place, showing the result of uniform planting of one species of tree on a street. The Norway Maples were set out in the spring of 1906; the photo was taken in the summer of 1907.

The principle behind the organization of these companies was the same as that behind many similar organizations; the joining together of public spirited citizens to supply a needed public service at reasonable cost. The results differ, because in these cases private interest was not permitted to secure control, and the public nature of the service is retained, and the public receives the benefit after the capital invested has received its predetermined just reward. The old company would have continued in business, furnishing natural gas at cost, if the supply had not given out. This plan was, perhaps, better than the new one, of transferring the plant to municipal ownership when the capital invested has been paid off, but the public nature of the business is fully recognized in any event.

The vigorous public campaigns for the sale of stock at $25 a share on monthly payments, resulted in many small stockholders, who became consumers and workers for the company, thus making easier the securing of business by the company.

The certainty of no water in the stock, and the publicity of accounts, as well as the supervisory power of the city officers, insure reasonable fixed charges and minimize the dangers of political manipulation, useless employes, misapplication of funds, so that the low price fixed for gas may be predicted in advance with reasonable certainty, and protected from unfair attack. The public interest in the company makes friends for it. The high character of trustees and directors promises the best of management, based on the highest principles and for the public benefit. The permanence of these boards and the continuance of their high character, as demonstrated by experience, gives this plan a great advantage over municipal ownership.

The original company was formed to enter into business in competition with companies seeking the same opportunity at much higher rates, and was the result of public enthusiasm over a new fuel and the determination to secure it at reasonable rates, so that the consumers, rather than the promoters of the companies, would reap the benefit from the unexpected bounty

of nature. The new company was formed to secure the existing mains of the old company and to continue this benefit in the more common field of gas manufacture. But the success of the first company and the successful fight of the new company against all sorts of opposition to its establishment demonstrate the soundness of the principle, and, while some other similar company in the gas field, not being able to secure a distribution system at a low price, may need to start with a higher price for gas at the beginning than the Indianapolis company has established, it can secure the other benefits, and the adoption of the graded scale of increase of dividend rate with decrease in price will give an empetus toward saving in cost, which, judging from English results, will produce even better results than those assumed in Indianapolis. There is no apparent reason why the method should not be applied to other public service industries, and be equally successful.

A MUNICIPAL FRANCHISE IS A VALUABLE ASSET AND SHOULD BE SO TREATED BY THOSE IN AUTHORITY.

By I. R. Breen, City Attorney, Watertown, N. Y.

A franchise is defined by Blackstone as a royal privilege or a branch of the king's prerogative subsisting in the hands of a subject. The Supreme Court of the United States has defined a franchise as a special privilege conferred by the government upon an individual or corporation, which does not belong to citizens of the country generally by common right. Webster defines a franchise to be a particular privilege conferred by grant from a sovereign or a government, and vested in individuals; an immunity or exemption from ordinary jurisdiction; a constitutional or statutory right or privilege.

In a broad and popular sense, the term "franchise," is used as synonymous with privilege, embracing the right of trial by jury, the right of habeas corpus, the right to vote at an election, the right to membership in voluntary associations or corporations, the right to hold office, etc.

However, it is quite essential to the character and nature of a franchise that it should be a grant from a sovereign or governmental authority. The authority which we are to consider in this paper is the municipality and the franchise or franchises which such municipality has power to grant. The only substantial asset which a municipality known as a city has, is its franchises, commonly known as gas, electric light, water and street railway franchises, and these franchises are so pertinent to the growth and prosperity of a city, whether large or small, that they lie at the very foundation thereof and their great value is difficult of estimation. These franchises, properly developed, become great arteries of life, happiness and prosperity, but when negligently and improvidently operated and controlled, they stifle the prosperity, growth, comfort and well-being of a municipality. Therefore, that branch of a city government usually known as the common

council, should use the utmost care and caution in the sale or disposition of any one of the franchises above named. A franchise never should be sold to speculators; that is, to parties who desire to purchase for the purpose of reselling to third persons or corporations and thereby making a profit to the city's disadvantage. Those in authority should never offer a franchise for sale at public auction, or otherwise, without thoroughly investigating as to whether the prospective buyer desires to purchase in good faith, and in the event that the franchise should be turned over to him, that he intends to push its development as a public utility to proper and efficient results. Inasmuch as when a city has disposed of a franchise it has forever lost practical control over it and cannot legally negotiate with other parties who would be willing to push the enterprise, it behooves officials to consider well before bartering away this most valuable asset of a city government.

Many a valuable franchise has been frittered away and substantially wasted by its falling into the hands of unworthy would-be promoters and speculators. For an illustration, we need go no farther than the City of Watertown, a beautiful little manufacturing city of about 30,000 inhabitants, located about ten miles from Lake Ontario in the northerly section of the State of New York. About twenty years ago, through its city fathers, it disposed of its street railway franchise to speculators who had no substantial financial backing, and these speculators and their successors, like Rip Van Winkle on the mountain, have slept and dreamed for twenty years, and do what it will, coax, nag, or urge what it may, the city has been unable to awaken them from their slumbers, while the people have suffered for want of street railway facilities. Watertown is a city that has grown quite rapidly of late on account of the development of its manufacturing interests, but is suffering keenly on account of a lack of street railway facilities, and it is fair to say that it would grow much more rapidly, and would be much more prosperous if this public utility had been placed into the hands of a person or corporation that had proper

financial backing and that had at the outset given substantial financial assurance of faithful performance of the trust. What is true in regard to a street railway franchise is true in a large measure in regard to all of the other franchises mentioned.

Officials of a city of the third class, as a rule, are especially anxious to develop its resources and often fail to hesitate and consider that the city in destined to live much longer than those in authority, and therefore, oftentimes instead of enhancing the welfare and prosperity of the city by the sale or disposition of a franchise, they thereby thwart and blast the fair prospects which a municipality has for future development along certain lines. This is but another evidence of the fact that we should impress upon common councilmen or aldermen that "public office is a public trust," and that they should perform their official duties with as much care and caution as they would their own private affairs, having an eye open always to the almost never-ending future of a municipality.

Again, when a franchise is disposed of by a municipality, great care should be taken in regard to the matter of legal restrictions. A franchise being a public utility and a kind of commonalty in which all of the people are interested, no undue advantage should be given a private corporation or person over the people generally. Thus, a city should always protect the people against unnecessary negligence and delay in the developing of a franchise granted, and should protect the people against any unnecessary encroachment of their public or private rights. In other words, using a figure, a municipal corporation should always have a legal string which it can pull to advantage when the owner of the franchise disposed of is inclined to neglect the best interests of the people, or is inclined to forget that a franchise should be treated as a public utility. No franchise, therefore, should be sold or disposed of without being accompanied by proper stipulations safeguarding the people's rights and protecting them from unwarrantable greed and encroachment, as without such stipulations, heartless money-getters will invariably take advantage of any legal

omission which has occurred through the neglect or inadvertence of officials at the time of the transfer.

Then, too, no franchise should be advertised for sale at public auction, or otherwise, without sufficient assurance that the prospective buyer not only in good faith desires to purchase, but that he is willing to pay a stated and acceptable price therefor. We have heretofore suggested that the franchises commonly known as gas, electric light, water and street railway franchises are the principal assets of a city. Therefore, they should not be wasted by disposing of them for a nominal figure or by giving them away in a frivolous or wanton manner. It is not uncommon that a franchise is disposed of or frittered away after the following method, viz.: John Doe, for instance, desires or thinks he desires to purchase a franchise for the purpose of speculation—that is for the purpose of selling it to a third party, and he therefore seeks out his friend Richard Rowe, whom the suffrages of the people have elected alderman. He makes known his desire to this official, and this official becomes interested and in turn interests his brother aldermen, and the deal is on, and the result is a sale of perhaps a valuable franchise at a nominal sum. In other words, the franchise is given away in a reckless and improvident manner without any thought on the part of the officials, and without any thought or consideration regarding the rights of future generations, and without any regard for the city's treasure. Why should these assets be given away or passed around to friends of councilmen? Why should the city's treasure be recklessly wasted in this manner? The answer is an axiom, and no process of reasoning or demonstration is necessary. Officials are too much inclined as a rule to treat the duties of their office as perfunctory, and therefore, the assets of a municipality are oftentimes handled with the recklessness of "all sail and no rudder."

Many years ago the Watertown Gas Light Company obtained a gratuitous grant of a gas franchise from the City of Watertown. This company has sold gas to the City of Water-

town ever since, and the plant has become a very valuable one, and in fact, so valuable that about three years ago, when this company petitioned the Public Service Commission to increase its capital stock, this franchise was put forth as an item of capitalization at the sum of $100,000. Thus, within the lives of many of those now living the franchise in question was recklessly and unwittingly disposed of without proper consideration by those in authority, which franchise in a comparatively few years was valued by its owner at the large sum above stated. The other franchises of the city, no doubt, are quite as valuable as the gas franchise under consideration, and were the city in possession of these franchises at the present time, it would thus have at least a half million dollars in assets along these lines. Surely, experience and observation teaches us that in the future it would be wise and proper for city officials to insist upon a reasonable consideration being paid the municipality upon the sale or disposition of a franchise, as what is true of Watertown in this regard is largely true of every other city of the third class.

While it is not within the province of this paper to advocate ownership under present conditions of public utilities by state or national governments, yet we do insist that experience and observation have taught us that it is neither wise nor prudent for a municipality to sell or dispose of its franchises, but rather it should retain and develop them. Municipal ownership naturally insures much better service. When public utilities, such as electric light, gas, water and street railway plants, are owned and controlled by private corporations or individuals, the tendency is to give inefficient service and to charge an exorbitant rate even for such service. The question of getting rich quickly is usually involved, and therefore, the people are usually deprived of the service and comforts from these utilities to which they are entitled. In the matter of the supply of gas and electric lighting, it is not difficult for the owner of the plant or plants to impose upon the people by furnishing an inferior product, and yet charge an exorbitant

price therefor, and if it is a matter of a street railway, it is quite as easy to give inefficient service and yet charge the usual rate. It is true, that in the State of New York we have what is known as a Public Service Commission which protects to a considerable extent the rights of the people in matters concerning public utilities, but the fact remains that it is almost an impossibility for a public service commission to regulate the standard of service which shall be maintained by private corporations or individuals who are in control of these public utilities, as oftentimes those in control are wily and unconscionable persons. Then, too, there is usually no regulation of these utilities by a public service commission except as the result of a petition being filed, and the public is inclined, as a rule, to be patient and long-suffering before any complaint is made, thus giving the owners of these utilities ample opportunity to defraud the public. Having had considerable experience along these lines as attorney for the City of Watertown in several litigations with the owners of its public utilities, we feel certain of our premises.

But, with public ownership of these utilities, these obstacles are largely removed, as the question of money-getting is not involved. The natural aim and object of a municipality, for instance, when it owns a public utility, is to give the best service possible at the least possible price, and the taxpayers are required to pay only the actual cost of production, as no dividends are to be paid private corporations or individuals. This is a great saving to taxpayers. Investigation shows, for instance, that the actual cost of manufacturing gas, including fixed charges, is only about sixty per cent. of the price usually paid by consumers in case it is furnished by a private corporation, and that electricity can be furnished for about fifty per cent. per kilowatt hour of what it usually costs the people when it is furnished by private corporations or individuals. The same rule applies in the matter of water and street railway utilities. The City of Watertown, as an illustration, owns and operates the plant furnishing its water supply, and comparison

shows that the people of this city are paying a much cheaper rate for its water supply than any other city within the State of New York where there is private ownership. The City of Glasgow furnishes an illustration. This city owns and operates both its gas and street railway utilities with the best results, both as to efficiency and price, and many of the cities of first, second and third class within the United States have adopted the plan of municipal ownership of public utilities with very practical and desirable results, both as to efficiency and as to cost of the product to consumers. It is true that it is often stated that it costs a municipality more than it does a private corporation to operate a public utility, but we suggest that when this is true, the reasons generally are that there is lack of organization and lack of discharge of duty on the part of public officials, and many times, by reason of political chicanery. To insure a high standard of service, we suggest that the ownership and operation of public utilities be entirely divorced from political strife and encounter.

Of course, there are certain influences sending out literature decrying the practicability of municipal ownership of public utilities. This, we reason, is but another scheme on the part of large corporations, and we may say, trusts, to throttle the tendency nowadays toward municipal ownership of such utilities. It is true that it is often impracticable for a city to establish municipal ownership of its public utilities after its franchises have been disposed of and the owners have established large and valuable plants, for in case the city establishes a plant under such conditions, it must purchase and take over the properties of the private corporation or individual, and oftentimes this is in a measure prohibitive on account of the enormous and unreasonable price which a municipality is required to pay. This is but another evidence of the fallacy of city officials casting franchises about as bread upon the waters. Finally, we say, all hail to the time when all municipalities shall be grounded in the principle of municipal ownership of public utilities.

REPORT OF THE COMMITTEE ON MUNICIPAL DATA AND STATISTICS.

J. W. Howard, C. E., Chairman.

A proper interpretation of carefully classified statistics, covering a reasonable period of time, is very instructive. They indicate tendencies and conditions to be avoided and to be encouraged. The material, mental and moral welfares of our cities are partly indicated by the following condensed statistics of one hundred and forty-eight (148) United States cities above 30,000 inhabitants each.

The following tables are based upon quantities from different parts of reports of the United States Census Bureau, published during the past five years, supplemented by later data from several cities. The statistics, percentages, etc., for 1907, are estimates made by the chairman of this committee based on the law of averages, deduced from the preceding five years' official quantities.

The special arrangement of the following tables is devised to best show comparisons and conclusions of the committee, as well as other conclusions which city officials and all who study the tables can deduce:

TABLE 1—MUNICIPAL RECEIPTS

Of 148 United States Cities Above 30,000 Inhabitants Each, for 1902-1906, and Estimated for 1907.

SOURCE	Per capita			Amounts			Per cent.	
	1902	1906	1907	1902	1906	1907	1906	1907
General property..	$13.08	$13.37	$14.07	$266,864,601	$315,264,805	$327,364,000	78.0	77.5
Special property and business.....	.35	.52	.55	7,239,430	11,838,3[illegible]5	13,000,250	2.9	3.1
Poll tax............	.05	.06	.06	920,472	1,245,764	1,326,250	.3	.3
Alcholic liquor and its licenses.......	1.30	1.63	1.71	26,563,285	36,755,381	39,318,000	9.2	9.6
Permits (exclusive of public service enterprises)......	.28	.37	.39	5,744,469	8,356,411	9,209,000	2.5	2.2
Miscellaneous......	1.04	1.16	1.19	21,176,902	28,571,645	30,425,000	7.1	7.3
Totals........	$16.10	$17.71	$17.98	$328,509,429	$402,042,371	$420,637,500	100.0	100.0

NOTE—Table 1 does not, of course, include money borrowed by cities and added to their debts. Such moneys are not true income.

TABLE 2—MUNICIPAL EXPENSES

Of 148 United States Cities Above 30,000 Inhabitants Each, for 1902-1906, and Estimated for 1907.

ACCOUNT	Per capita			Amounts			Per cent.	
	1902	1906	1907	1902	1906	1907	1906	1907
General Govt......	$1.64	$1.51	$1.48	$33,546,655	$34,089,572	$34,227,052	10.3	10 1
Police..............	1.90	2.01	2.04	38,667.664	45,319,353	46,979,000	13.7	13.7
Fire................	1.33	1.51	1.55	27,044,428	34,092,900	35,853,000	10.4	10 4
Health..............	.22	.23	.23	4,399,624	5 212,831	5,415,000	1.6	1 6
Sanitation..........	.91	1.19	1 26	18.577,678	26,780,176	28,830,000	8.1	8.5
Highways...........	1.72	1.73	1.73	35,051,778	38,989,654	39,975,000	11.9	11.7
Charities and corrections..........	.86	.92	.94	17,523,992	20,801,724	21,620,000	6.3	5.9
Schools............	3.69	4.25	4.39	75,224,638	95,914,062	101,036,000	29.2	29.6
Libraries, museums, etc....	.16	.20	.21	3,309,333	4,440,431	4,697,000	1.3	1.3
Parks, recreation..	.60	.50	.46	12,244,365	11,220,347	10,964.000	3.4	3.2
Miscellaneous......	.33	.55	.61	7,026,158	12,698,921	14,116,000	3.8	4.1
Totals........	$13.36	$14 60	$14.90	$272,616,313	$329,560,031	$343,711,052	100.0	100.0

NOTE—Table 2, does not include, of course, certain outlays for permanent improvements, payments on account of certain debts and sinking fund operations.

LESSONS FROM MUNICIPAL RECEIPTS.

Table 1 shows that during the past five years the representative cities of the United States have collected from the people an increasing amount of money per capita per year. This increase of taxation for municipal purposes has been from $16.10 to $17.98, or $1.88 in five years, or at the rate of seventeen (17) cents per inhabitant per year. The annual increase has been about $18,600,000. It is observed that alcoholic liquor and matters connected with it have been made to pay the largest increase per capita and that an increasing per cent. of the total receipts has been annually received from this source. It is interesting to note in this connection in Table 2 the corresponding increase per capita of municipal expenses for police, charities and correction departments.

Table 1 shows that general property is taxed at an increased rate per capita, but is fortunately made to bear a decreasing per cent. of the total cost of cities.

The income from permits is slightly increased per capita. This does not include receipts from public service corpora-

tions and those of a semi-such nature, as street railways, lighting, water companies, etc. Such statistics are not yet possible to be obtained except in a few cases where Public Service Commissions are regulating these branches and obtaining the facts. This source of income should steadily and largely increase, as franchises and true values of plants are taxed on the same basis as other real estate and personal property.

LESSONS FROM MUNICIPAL EXPENSE.

Referring to Table 2, we observe that the total expense for maintaining those representative cities has been increasing at about $14,300,000 per year, or from $13.36 to $14.90, or $1.54 in five years, or at a rate of about 30 cents per capita per year. While the general administration expenses of mayors, aldermen, etc., have been decreasing, the police, correction and charity departments are unfortunately costing more and more, the causes of which are a subject worthy of special investigation. The fire departments are causing increased cost per capita per year. Assuming that this does not represent wastefulness or inefficiency, it indicates that our cities are not constructing a proper increasing proportion of fireproof and slow burning buildings. It is believed by many that if the increasing cost of the American fire departments, together with a large portion of money paid for insurance premiums were invested in more fireproof buildings, the cost of fire departments and insurance would be reduced rapidly and enormous fire losses would be lessened. There are relatively small losses by fire in Europe, and very low cost of fire departments. The fireproof construction limits in our cities should be extended.

The increased cost of sanitation, when compared with the lowering death rates of cities is wise. It is an indication that our cities are better sewered, cleaned, etc., from year to year. Improved garbage collection and disposal can help reduce the sanitation cost of cities as is done in many places.

The construction of highways, which includes the expensive item of street paving, shows that there has been no increase per

capita per year, and that a decreasing per cent. of the total expenditures of cities is for this important function. The pavements of American cities are not keeping up to the growth of cities and are too often carelessly laid, or when well laid, their proper constant maintenance is neglected. The few prominent exceptions in several cities prove this rule to be true. Constant, good and economic maintenance and not cheap first cost is real paving economy and efficiency, and are thus always in order for public use.

The increased cost of schools has been from $3.69 to $4.39 per capita in five years, or at the average rate of 14 cents per capita per year. This total increase per annum for these 148 representative cities has been about $5,122,000. This has been the largest increase per capita and in total amount of all the different branches of city expenses. It is now 29.6 per cent. of those city expenses. This is fortunate, as it indicates that what is wanted in our nation is being put into the schools. The fruits will appear as the children become of age and in turn manage our cities better than we do. As to parks, we now feel that the large outlays for land have been made and their cost is now practically one of equipment and maintenance, which accounts for this reduced expense. We can well be proud of our parks, their financial and beneficial results.

GRAND TOTAL RECEIPTS AND EXPENDITURES.

There are some items which could not be included in Tables 1 and 2, such as money borrowed, payments of loans, sinking fund operations; also income from waterworks, street railway and other quasi-public monopolies, franchises, etc. Taking all these into account, including all transactions of one hundred and forty-eight (148) cities for 1906, we note the grand total receipts to be $610,000,000, which was in increase over 1902 at a rate of about $32,975,000 per year, or a total five years' increase of moneys obtained of $131,900,000, or 27.4 per cent. from 1902 to the end of 1906. When we learn from Table 1 that the increase of receipts from the direct taxes there enume-

rated, for the same period has been about 27 per cent., and take into consideration the increase in grand totals just shown, we conclude that cities borrow increasing amounts for future generations to pay and use much of such, the proceeds from loans to pay for pavements, etc., and even more temporary things which have a life of less length than the loans. Instances constantly arise where officials for party or personal reasons make an apparent low tax rate by using money from loans for what are really current expenses of maintenance, also forgetting depreciation of structures of all kinds. This is injustice to their own and other children, who, as later taxpayers, must pay for what had been consumed by a previous generation. It is worth a careful note that while the income of these cities in 1906 from taxes, etc., in Table 1, was $402,042,371; the total obtained from all sources, including loans was $610,000,000, of which $207,957,629 was largely from loans. Cities should live more within their income from annual taxes, earnings, franchises, and less from loans. Steps should be taken to increase annual income and to have more economical and efficient city officials and employees in many cities where practical politics for selfish or mercenary motives prevail.

This brings us to the next important matter, which is the grand total expenses and outlays of these 148 cities, including improvements of more or less permanent character, payments of some old debts, etc. These were in 1906, the sum of $606,571,000, which is 29.2 per cent. greater than in 1902.

These expenditures can be approximately distributed thus:

For current expenses.........	in 1902,	71.2%;	in 1906,	67.6%
For outlays for improvements..	in 1902,	27.3%;	in 1906,	31.4%
For reduction of debt.........	in 1902,	1.5%;	in 1906,	1 %
		100 %		100 %

Some of these improvements were temporary. The reduction of debt is less than formerly.

Let us next consider the total net debt of 158 cities of above 30,000 inhabitants, at the end of 1906, which was the enormous

amount of $1,385,841,497. For a total population of these cities 22,907,690, it was $60.54 per capita, which is an increase of 23.1 per cent. over $49.16, the per capita debt of 1902. It is appalling to compare this large debt of the 22,907,690 people of 158 cities with the government debt of the 84,154,000 people of the United States the same year, which was only $964,435,687, or only $11.46 per capita. In other words, these cities owe a total of 43.6 per cent. more than our government, or $431 per cent. per capita more than the per capita debt of the United States government.

If it were possible to get as complete statements from the 915 cities of over 5,000 people each in our country, as have been obtained from the 158 larger cities, the results would be equally instructive.

Sufficient information, however, has been obtained by correspondence with about 600 cities to believe that the same general conclusions, with some cities excepted, apply to all our cities. The wise, economic, just and safe financing of our cities is becoming a more and more serious and difficult problem, which demands officials of integrity, education, experience and diligence. With the constantly increasing number of such men in the legislative, judicial, administrative and executive offices of our cities and trained men and experts as employees protected by civil service laws, we will have more economic, more efficient, more healthful, better, handsomer and pleasanter cities. It is generally conceded that badly governed cities are weak elements of our nation. Improved city governments are appearing in city after city and good government is bound to become a strong factor of municipal prosperity and contentment of the people.

MUNICIPAL ACCOUNTS IN THE ABSTRACT.

By A. M. Heston, City Comptroller, Atlantic City, N. J.

Some years ago, in a wordy discussion on the subject of the taxing and spending powers of cities, a Chicago writer said: "If there is anything clearly taught by experience, it is that those who exercise taxing and spending powers must be guided by correct accounts and reports." Recently the question was asked: "Which is of most importance to the taxpayer—the taxing power or the spending power; the source of revenue or the object of expense; where the public money comes from, or how it is spent?" The reply of a New York gentleman was that taxing and spending powers are legislative in their character; what the taxpayer wants to know, first of all, is whether the dollar he pays in taxes is applied to a good and lawful purpose; whether ninety-five per cent. of that dollar goes for general maintenance and improvements, and not more than five per cent. for the cost of collecting and expending city cash. The five per cent. is supposed to represent the item of salaries in the annual budget.

Evidently this gentleman, having in mind the usual fee for mercantile collections, considered five per cent. a proper sum for services rendered by officials or departments in collecting and expending public funds. We have no statistics covering this particular question, but it may interest you to know that in Atlantic City, with annual expenditures exceeding one and a half millions of dollars for all ordinary purposes, the salary budget of the legislative and executive departments, representing the cost of collecting and expending public funds, is about three and one-half per cent. of the whole.

You will notice that I use the word "ordinary," in referring to expenditures, thereby distinguishing current expenses from the cost of public improvements. One represents the disbursements of moneys received from taxes, licenses and permits; the other the proceeds of bonds. A well known ex-

pert accountant, Mr. Duncan MacInnes, of New York, objects to the terms "ordinary" and "extraordinary" in city accounts, and suggests "revenue" and "capital" in their stead. The first named, I think, are appropriate terms, and preferable to those suggested by Mr. MacInnes. They have been developen out of the experience of European cities and states, and have been used in the fiscal reports of France for more than sixty years. I understand that in the accounts of Berlin, also, the same terms—ordinary and extraordinary—are used, and the reports of many British cities are drawn upon the same basis. The significance of the terms is discussed at length by Prof. Adolf Wagner, a German writer and financier. It thus appears that Atlantic City, in using the terms "ordinary" and "extraordinary," in her annual reports for some years past, has been adhering to approved nomenclature.

We may assume that the average taxpayer cares more about how the money is spent than where it comes from, and we may also assume that he is not always fairly treated in the matter of expending public funds. At least ninety-nine per cent. of the officials are honest, and yet very often the taxpayer does not get the worth of his money. He has a right to know exactly how the money goes, and in order that he may learn whether he has been fairly treated he should have the right of access to every contract, every bill and every payroll that goes to make up the annual expenditure. At the end of each year he should also have a report of all the receipts and disbursements, the assets and liabilities, which report should be so plain that the man on the street can understand; can tell exactly what the city has received in cash and how much it has paid out; where the money came from and to whom it was paid; what the city owns and how much it owes. A New York gentleman, a certified public accountant, objected to the Atlantic City report because it told too much. He thought we should give summaries and not details; total expenditures and not amounts paid to individuals. The Atlantic City report gives both.

A Western official, Comptroller Betz, of St. Paul, says: "The government of cities is of a paternal nature—simply collecting money and expending it again," which means that while commercial accounting is focused on the profit and loss account, in municipal accounting there is no profit and loss, and the accounting officer must work upon different lines. Mr. Betz adds that he does not believe in the common phrase, "business methods in public offices," but in the more apt term, "public methods in public offices."

Inasmuch as municipalities do not enter into business for profit and are unlike private corporations, it follows that their affairs lead up to different conclusions. Every taxpayer may be considered a stockholder in the municipal corporation, and his dividends come to him in the shape of good government and public improvements—and sometimes a lower tax rate. He can determine for himself whether his stock is above or below par after he has contemplated existing conditions and studied the annual report. The fact is, when he has the annual report he has the conclusion of the whole matter, for at the end of the year the accounting officer of the city shows the final result of the year's business. This information is given to the taxpayer in the form of an intelligent abstract of all the city accounts for the year.

The average taxpayer cares more about results than about how the books are kept, but in submitting his abstract the accounting officer necessarily relies on his own accounts, which, if intelligently kept, will enable him to submit a comprehensive exhibit of the year's business. These accounts, of course, should be so kept that the ordinary bookkeeper, as well as the expert accountant, having access to them, could, if necessary, prepare an abstract and submit it to the public in the form of a report.

Having connected the terms "report" and "abstract," I may state, just here, that the title of this paper may be thus paraphrased: "The accounts of a city as summarized in the annual report, without reference to a particular system of

bookkeeping.'' I repeat the words, ''without reference to a particular system of bookkeeping.''

During the last six or eight years, government agents, public accountants and city auditors have been devoting much time, a great deal of thought and lots of energy to the solution of one of the problems of municipal improvement societies, namely, the formation of a uniform system of accounting. From time to time, at least since the summer of 1903, the Census Bureau has offered suggestions to city comptrollers and advice to uninformed officials regarding an improved method of keeping accounts.

We have been told by the census man that for lack of uniformity he has found it impossible to give to the country such an exhibit of receipts and disbursements as is desirable, and that because of the crude methods of bookkeeping in some cities the special agents have been unable to prepare comprehensive reports on city finances. These conditions, they say, are a disappointment to all students of municipal finance.

Just here let me say that you will not meet anywhere a nicer lot of gentlemen than these special agents of the Census Bureau. I like them. One of them visited Atlantic City recently, stopping at the Hotel Dennis, and according to the daily reports which he brought to my office he lived on the good things of this land—and Uncle Sam paid the bill; but he did his work well, and neither Uncle Sam, nor Proprietor Buzby, nor your humble servant has any cause for complaint on the score of public service acceptably rendered.

Regarding the doings of these agents and the desires of Director North, I am sometimes inclined to ask: ''In seeking to introduce a uniform system of accounting in cities, is not the government striving after the unattainable? Are the results to date encouraging or is the effort toward uniformity a failure?'' I surmise that there can be nothing like real uniformity in city accounts until there is uniformity in city charters. On the other hand, uniformity in the statement of facts may bring about uniformity in reports, which is the real need,

and this in turn will contribute to the ultimate standardization of accounts.

One of the objects of standardization—a broader word than uniformity—is to secure data whereby the expenses of various cities may be compared; but in comparing city accounts it is necessary to know whether departments having the same name in different cities perform the same kind of service. How shall we compare the two cities—Baltimore and Louisville—for instance, with the one having an independent license board, besides its board of police, and the other with the license power vested in the sinking fund commissioners? What brand of uniformity will you place on the two New Jersey cities—Elizabeth and Atlantic City—with the comptroller of Elizabeth serving also as the collector of taxes and the comptroller of Atlantic City not so much as seeing the color of the city's money, excepting the stipend that comes to him in the form of salary once a month, after it has been in the coffers of the tax collector, the city treasurer and the city depository?

Speaking lightly, what would become of your "uniformity," if, after creating a water board that annually furnishes thirsty Atlantic City visitors with two billion gallons of water, city council should vest in that water board the power to grant licenses? If a sinking fund commission can grant licenses, why not a water board? In that case, how much of the two billion gallons of water consumed every year in Atlantic City would be used to dilute the monthly quota of say thirty gallons of whisky? Would Atlantic City hold her fort against the advancing army of teetotalers; or, with her phalanx of 700 hotels, some with and others without, would she capitulate to the "drys?" and say, "My name is Dennis!" Forsooth, would Atlantic City go dry on Sundays with the water board changed to a license board and dispensing 3,805 gallons of pure, crystal, sparkling water every minute?

Think of it! Nearly 4,000 *gallons* of water a minute and only the two-hundredth part of a *gill* of whisky! Nearly

22,000,000 quarts of water a day and only *four* quarts of whisky, for a city with an average population of 100,000! And yet they say only a few people in Atlantic City ride on the water wagon!

Seriously, instead of uniform bookkeeping, is it not, as I have already said, the standardization of accounts that we need, whereby we may have uniform reports, rather than uniform accounts? After all, the result is what counts, and it does not matter what form of bookkeeping a comptroller may adopt, so long as he can produce from his records an abstract that approaches the ideal report.

To that end, the report should be sufficiently full and explicit to answer the purposes of the statistician, who will not be under the necessity of doing bookkeeping work to justify his conclusions; and it should also present a classified statement of the receipts and expenditures, the revenue and expense, the assets and liabilities, the taxes assessed, collected and delinquent, the cost and present value of public improvements, the condition of appropriations at the end of the fiscal year, the names of those to whom the money was paid (excepting possibly in very large cities) and any other information that will likely interest members of the body politic.

It is my conviction, based on experience, that the services of an expert accountant are not necessary in the preparation of such a report. Experts are all right in their place, and their place is at the books, to straighten out difficulties and make plain the path of the ordinary bookkeeper who may have lost his way. His services may be wisely dispensed with when it comes to making up the report. The fiscal reports of cities, like faithful witnesses, should tell nothing but the truth. They should contain no vague statements, no complex exhibits.

Expert reports may present the truth to suit the expert, but they seldom suit the average citizen. Secretary Cortelyou, addressing a conference of accountants and comptrollers at Washington in 1903, said: "The municipal reports frequently fail to tell the truth, and sometimes place the facts in such

relation as to deceive the people." We are not informed as to the name of the particular expert Mr. Cortelyou had in mind when he made this statement, but it brings to my mind the Sir Henry Wotton definition of an ambassador—"An honest man sent to *lie* abroad for the good of the commonwealth." I sometimes think that an expert may be defined as an honest man employed to tell the truth by deceiving the public.

Getting back to the question of uniformity in accounts, it may be safely said that scarcely two cities keep their books in such shape that the receipts and expenditures for particular purposes can be compared with similar receipts and expenditures in other cities. There are twenty-three cities in New Jersey, eight of them with a larger permanent population than Atlantic City, and only three that expend more for fire protection, one that expends more for streets, three for lighting, four for police, six for schools, none for boardwalk, and none with as large a wealth per capita; and yet, notwithstanding our excellent showing in fire apparatus and the large expenditure for fire protection, no city in New Jersey has such excessive rates of insurance. In no case have I succeeded in getting a report that can be used satisfactorily in comparing the cost of general administration with similar cost in Atlantic City.

While on the subject of fire and fearing that you may be disposed to "fire" me out of the association if I do not keep a promise, made in good faith to your Secretary, Mr. Folwell, I venture to say something, at this time, about the method of accounting devised by me and used successfully in Atlantic City. Scarcely ever has a chain been forged without a flaw in its links. The Atlantic City chain of accounts had some flaws, which were happily discovered and the links discarded.

As the warrant books, or rather the stubs of the warrant books, show the original entries, I will first describe the method of drawing and issuing warrants. All warrants, excepting those of the Water Department, Board of Education and Board of Health, originate in the comptroller's office, and are signed

by him after the respective claims have been approved by the proper committee of council and the mayor, and after they have been audited by the comptroller. All other warrants are countersigned by the comptroller. In most other cities all warrants are drawn by the city clerk or by the department having charge of a particular fund, and are duly countersigned by the comptroller.

The Atlantic City warrants are applied to the bills or payrolls by two clerks, or by the comptroller and one clerk, before they are signed. In that way the work of two clerks is checked up by one clerk and the comptroller, and after the warrants have been cashed by the city treasurer they are again applied to the treasurer's cash book and to the stubs by two clerks, neither of whom is permitted to draw any warrants. The work of the office is so arranged that four clerks, including the stenographer, check against each other. Mistakes are thus eliminated and fraud made impossible, without collusion between at least four persons.

Before a warrant leaves the comptroller's office it is scheduled in duplicate and the duplicate sheet is filed with the treasurer. As the warrants are redeemed by the treasurer they are checked off his list. Every warrant issued is credited to the treasurer's account, as if already paid, and in that way we have a correct record of his net cash balance.

Our books are arranged to show at a glance the amount received to date for current taxes, delinquent taxes, liquor licenses, mercantile licenses, fines, costs, permits, interest on taxes, costs on taxes, the proceeds of bonds and every other separate source of revenue; also the ordinary expenditures classified by appropriations, and the extraordinary disbursements subdivided; the revenue and expense to date, condition of the sinking fund, the cost of schools, the receipts and expenditures of the Water Department, Board of Health, and so on. The accounts are so kept that we can also show at a glance how much has been paid to any individual who has done business with the city, either in the way of supplies, repairs or im-

provements; for salary or for sundries. These payments are all classified by appropriations on the individual ledger, and the penciled footings show the actual amount paid to date to every individual on account of a particular appropriation. These penciled footings must agree in the aggregate with the footings on the warrant book stubs and with the expenditures as shown on both the day-book and general ledger. Thus we have a fourfold record and check on accounts, kept by the general bookkeeper and the warrant clerk.

In some respects our system of bookkeeping may be unlike that of any other city, but I feel justified in saying that it is a fairly good one; otherwise we could not prepare from our records a report that is approved by the taxpayer, the accountant and the statistician—one that has been forwarded, upon request, to a considerable number of officials and accountants in other cities.

Our books consist of twenty-four warrant books—one for each important appropriation—day-book of receipts and expenditures, journal, general ledger, special ledger, individual ledger, sinking fund cash book and ledger, coupon book, revenue and expense book, license book, permit book and a few other minor books of record.

The day books of receipts and expenditures and the general and special ledgers have been pronounced models by the special agents from Washington, who have visited the office a number of times.

[Recurring to the subject of municipal accounts in general, may I not suggest that the advocates of uniformity do not attempt an elaborate system of bookkeeping to supplant existing systems, but that they confine their efforts to devising a practical scheme for summarizing the accounts of any city, whatever its system of bookkeeping, in the form of a model comptroller's report? This is what we are trying to do in Atlantic City. We have our own system of bookkeeping—different, perhaps, as I have said, from that of any other city in the country—and we are trying to get results.]

CITY TREASURER, Cr.

DATE		JOURNAL	GENERAL FUND	BOND ACCOUNTS									
				WATER DEPARTMENT	CITY IMPROVEMENT	PAVING	CITY PARK	CITY HALL	CREMATORY	FIRE HOUSE	WATER IMPROVEMENT	SIDEWALKS	

Special Ledger.

				TOTAL
	BILL RENDERED	BILL RENDERED	BILL PAID	

Individual Ledger.

NAME OF BOND	DATE OF ISSUE	No. of Bonds Issued	No. of Coupons Redeemable	1	2	3	4	31	32	33	34	35	36	37	38	39	40	41

Coupon Book.

PLATE II

CITY TREASURER,
To CITY OF ATLANTIC CITY, Dr. Record of Comptroller's. Department.

DATE	FINES RECORDER	COSTS DIST. COURT	LICENSES Liquor	LICENSES Mercantile	BOARD OF HEALTH	REG. OF DOGS	BUILDING INSPECTOR	STREET OPENINGS	ELECTRICIAN	STREET DIRT		TOTAL Fines, Licenses, &c.	BILLS PAYABLE
TOTAL,													

JOURNAL PAGE.

MEMO.
- Recorder's Fines to date,
- District Court Costs to date,
- Liquor Licenses to date,
- Mercantile Licenses to date,
- Board of Health Fees to date,
- Registration of Dogs to date,
- Building Inspector's Fees to date,
- Street Openings to date,
- Electrician's Fees to date,
- Redemption of Dogs to date,
- Street Dirt Sales to date,
- Parade Permits to date,
- Rent of Crematory Lands to date,

MEMO.

MEMO.

MEMO.

Day Book of Receipts I.

CITY TREASURER,
To CITY OF ATLANTIC CITY, Dr.

Record of Comptroller's Department.

DATE	CURRENT TAXES	DELINQUENT TAXES			TOTAL: Delinq. Taxes	R. R. TAXES — Franchise Taxes	WATER DEPT. Water Rents, &c.	SPECIAL FUNDS				TOTAL SPECIAL FUNDS
	Prin.											
	Int.											
	Costs											
	Prin.											
	Int.											
	Costs											
	Prin.											
	Int.											
	Costs											
	Prin.											
	Int.											
	Costs											
TOTAL,	Prin.				Prin.							
	Int.				Int.							
	Costs				Costs							
JOURNAL PAGE,		JOURNAL PAGE.						JOURNAL PAGE,				

MEMO.

Current Taxes to date—principal,
" " " —interest,
" " " —costs,
Delinquent Taxes to date—principal,
" " " —interest,
" " " —costs,
Railroad Taxes to date,
Franchise Taxes to date,

MEMO.

Water Department—Rents, &c. to date,
City Improvement Bonds to date,
City Park Bonds to date,
Water Bonds to date,
Paving Bonds to date,

Amount Brought Down—Fines, Licenses, &c.,
" " " —Bills Payable,
" " " —Current Taxes—principal,
" " " " " —interest,
" " " " " —costs,
" " " —Delinquent Taxes—principal,
" " " " " —interest,
" " " " " —costs,
" " " —Railroad and Franchise Taxes,
" " " —Water Department,
" " " —Special Funds,

Amount Brought Forward,
Amount Carried Forward,

Day Book of Receipts II.

PLATE IV

TREASURER ATLANTIC CITY BOARD OF EDUCATION,

In Account with the City Comptroller.

	WARRANTS COUNTERSIGNED AS FOLLOWS:			SALARIES		REPAIRS AND SUPPLIES			SUNDRIES		TOTAL	PERMANENT IMPROVEMENTS	
	DATE	WARRANT NO.	NAME	TEACHERS AND OFFICERS	MANUAL TRAINING	BUILDING	BOOKS AND APPARATUS	FUEL AND JANITORS	LOANS AND INTEREST	MISCELLANEOUS			
													PAGE
			TOTAL										

EXPENDED FOR SALARIES TO DATE	AMOUNT BROUGHT DOWN FOR SALARIES, SUPPLIES AND SUNDRIES
" " REPAIRS AND SUPPLIES TO DATE	" " " " IMPROVEMENTS
" " SUNDRIES TO DATE	" BROUGHT FORWARD—GENERAL
" " IMPROVEMENTS TO DATE	
TOTAL	AMOUNT CARRIED FORWARD

TREASURER ATLANTIC CITY BOARD OF HEALTH,

In Account with the City Comptroller.

WARRANTS CO. NTERSIGNED AS FOLLOWS:

	DATE	WARRANT NO.	NAME	SALARIES	SUPPLIES	SUNDRIES	HOSPITAL						TOTAL	
														PAGE
			TOTAL											

EXPENDED FOR SALARIES TO DATE	AMOUNT BROUGHT DOWN FOR SALARIES, SUPPLIES, &c.
" " SUPPLIES TO DATE	BROUGHT FORWARD
" " SUNDRIES TO DATE	
" " HOSPITAL TO DATE	
TOTAL	AMOUNT CARRIED FORWARD

PLATE V

Number of Warrant	Amount of Warrant	Water Rent Rebates	CONSTRUCTION																		
			FORCE MAINS					DISTRIBUTION MAINS				BUILDINGS			ENGINES AND BOILERS			BASINS, WELLS AND FLUMES			Total for Construction
			Pipes and Specials	Lumber	Valves	Labor	Total	Pipes and Specials	Valves and Hydrants	Labor	Total	Material and Freight	Labor	Total	Material and Freight	Labor	Total	Material and Freight	Labor	Total	
10	100 00																				
11	475 00																				
12	315 00																				
	890 00																				

Water Department Voucher Book I.

Date of Issue	Number of Warrant	NAME OF PARTY IN WHOSE FAVOR WARRANT IS DRAWN	MANAGEMENT														
									DISTRIBUTION MAINS			VALVES AND HYDRANTS			STAND PIPES		
			Salaries, Clerk Hire and Labor	[illegible]	Stationery and Printing	Taxes	[illegible]	Total	Material	Labor	Total	Material	Labor	Total	Material	Labor	Total
1908																	
Jan 1st	10	J. S. Mulford Har										57 00		57 00			
"	11	Geo. B. Newton & Co															
"	12	Neptune Meter Co															
														57 —			

Water Department Voucher Book III.

METERS			PUMPING EXPENSES					STREET SERVICES					
Meters and Connections	Labor	Total	Salaries and Wages	Fuel and Hauling	Supplies	Incidentals	Total Pumping Expenses	Material and Freight	Labor	Tools, &c.	Total for Street Taps	SUMMARY OF WARRANTS PAID DURING MONTH OF Jany. 1908	
												Management and Repairs,	175 00
												Rebates,	
				475 00			475 00					Interest,	
240 00		240 00										Meters,	240 00
		240 00					475 00					Sinking Fund,	
												Construction,	
												Pumping Expenses,	475 00
												Street Services,	
													890

Water Department Voucher Book II.

AND REPAIRS																	
FORCE MAINS			BASINS, WELLS AND FLUMES			METERS			MISCELLANEOUS			PUMPING STATIONS			Total Expenses for Managem't and Repairs	INTEREST	SINKING FUND
Material	Labor	Total	Material	Labor	Total	Material	Labor	Total	Material	Labor	Total	Material	Labor	Total			
												50 00		50 00	100 00		
						75 00		75 00							75 00		
								75 —						50 —	175 00		

Water Department Voucher Book IV.

CITY OF ATLANTIC CITY,
To CITY TREASURER, Dr.

WARRANTS DRAWN AGAINST GENERAL FUND AS FOLLOWS:				LIGHTING			PRINTING			POOR		
DATE	Warrant No.	NAME	DESCRIPTION	Arc Lights	Gas Lamps	Sundries	Advertising	Books	Sundries	Board	Burials	Sundries
		TOTAL										
		LEDGER PAGE										

SUMMARY					
GENERAL FUND—CASH (CITY OF ATLANTIC CITY), DR. TO CITY TREASURER,	Journal p.			LIGHTING EXPENDITURES TO DATE,	
SPECIAL FUND—AMOUNT BROUGHT DOWN,	"			PRINTING " "	
" " " " "	"			POOR " "	
" " " " "	"			PROPERTY " "	
" " " " "	"			SANITARY " "	
" " " " "	"			FIRE " "	
" " " " "	"			POLICE " "	
" " " " "	"			DETECTIVE SERVICE " "	
" " " " "	"			BOARDWALK " "	
" " " " "	"			PUBLIC COMFORT " "	
" " " " "	"			STREETS " "	
TOTAL.				TOTAL.	

General Day Book of Expenditures I.

Record of City Comptroller.

PROPERTY			SANITARY		FIRE		POLICE	
Repairs	Supplies	Sundries	Garbage	Sundries	Pay Rolls	Sundries	Pay Rolls	Sundries

SALARIES EXPENDITURES TO DATE,	
BOARDWALK ILLUMINATION TO DATE,	
INTEREST ON BONDS TO DATE,	
INTEREST ON TEMPORARY LOANS TO DATE,	
REFUSE BOXES TO DATE,	
LEGAL EXPENSES TO DATE,	
BOARD OF HEALTH APPROPRIATION TO DATE,	
FIRE SERVICE, STREET SPRINKLING AND FLUSHING, AND WATER FOR PUBLIC USES TO DATE,	
LIBRARY APPROPRIATION TO DATE,	
SURETY BONDS TO DATE,	
TOTAL,	

General Day Book of Expeditures II.

CITY OF ATLANTIC CITY,
To CITY TREASURER, Dr.

	BOARDWALK			PUBLIC COMFORT			STREETS			SALARIES	INTEREST ON BONDS					TOTAL GENERAL FUND
	Pay Rolls	Repairs	Sundries	Pay Rolls	Rents	Sundries	Pay Rolls	Supplies	Sundries							
TOTAL,																
LEDGER PAGE,																

TEMPORARY LOANS TO DATE,		CHARITIES TO DATE—ATLANTIC CITY HOSPITAL,		STATE SCHOOL TAX,		
ELECTRICAL DEPARTMENT TO DATE,		—ATLANTIC CITY DAY NURSERY,		COUNTY TAX,		
ENGINEERING DEPARTMENT TO DATE,		—FLORENCE CRITTENDON MISSION,		CITY SCHOOL TAX,		
BUILDING DEPARTMENT TO DATE,		—PREVENTION OF CRUELTY TO ANIMALS,		SPECIAL DISTRICT SCHOOL TAX,		
ELECTION EXPENSES TO DATE,		—PUBLIC FOUNTAINS,		SINKING FUND,		
MEMORIAL SERVICES,		—FIREMEN'S PENSION FUND,				
ARMORIES,		—VOLUNTEER FIREMEN'S ASSOCIATION,				
CONTINGENT EXPENSE FUND,						
TOTAL,		TOTAL,		TOTAL,		

General Day Book of Expenditures. III.

Record of City Comptroller.

SPECIAL FUNDS	
SPECIAL FUND TO DATE—	
" " TO DATE—	
" " TO DATE—	
" " TO DATE—	
" " TO DATE—	
" " TO DATE—	
" " TO DATE—	
TOTAL EXPENDITURES TO DATE ON ACCOUNT OF SPECIAL FUNDS.	
SUMMARY ON PRECEDING PAGE—GENERAL FUND,	
SUMMARY ON PRECEDING PAGE—SPECIAL FUNDS,	
AMOUNT BROUGHT FORWARD—GENERAL AND SPECIAL,	
TOTAL CARRIED FORWARD—GENERAL AND SPECIAL,	

General Day Book of Expenditures IV.

PLATE XI

CITY OF ATLANTIC CITY,
To CITY TREASURER, Dr.

Record of Comptroller's Department.

BILLS OF WATER DEPARTMENT APPROVED AND WARRANTS ISSUED AS FOLLOWS:

			OPERATING				CONSTRUCTION			FINANCIAL			
DATE	WARRANT NO.	NAME	MANAGEMENT AND REPAIRS	PUMPING EXPENSES	STREET SERVICE	RENTS, REBATES AND PENALTIES	EXTENSIONS	METERS		INTEREST	SINKING FUND	TOTAL	
		TOTAL											

OPERATING EXPENDITURES 10
CONSTRUCTION
FINANCIAL
TOTAL

AMOUNT BROUGHT DOWN FOR OPERATING, CONSTRUCTION AND FINANCIAL
" FORWARD
AMOUNT CARRIED FORWARD

Department Day Book of Expenditures.

I wish to speak briefly on another subject affecting municipal finance. According to statements made by government agents, the reports of comptrollers and auditors and verbal statements by officials who have visited our office, Atlantic City has a feature in municipal financing that is unknown in the other important cities of the country. In this city we never have any "outstanding warrants." I mean by this that we never have any warrants issued and outstanding for a number of months or years, as is the case in many other cities. Occasionally a warrant may be held a month before presentation at the bank or treasurer's office to be cashed, but ordinarily all warrants are redeemed within ten days from the date of issue. If the city is short of cash, we borrow from the banks, offerings uncollected revenue as collateral, and we pay all bills within two weeks after approval, with warrants that may be cashed immediately. In my opinion, a city has no more right to issue a warrant, registered or unregistered, without having the funds on hand to cash the same, than has an individual to sign his check with no funds in bank. A well-governed city should have a credit that would enable it to borrow all necessary funds to meet current expenses, by pledging its uncollected revenue as collateral. Warrants registered for payment at some future time should be unknown.

At the beginning of each week the treasurer of Atlantic City receives the cash collections of the several departments for the preceding week, and on the same day they are charged against him on the books of the comptroller. To that end, each department is required to make a duplicate report to the comptroller, and at the end of each year these weekly reports are bound together—each department by itself—and thus constitute a part of the city records. The treasurer's accounts are audited once a month, and the weekly reports, filed with the comptroller, are checked against the treasurer's accounts.

All licenses and permits issued by the Building Department, Highway Department, Electrical Department, Mercantile Appraiser and Board of Health must be countersigned by and

filed in duplicate with the comptroller. A daily record of these licenses and permits is kept by the comptroller, so that we can tell at any time just how much money has been collected by a department and how much has been paid by that department to the treasurer. Should there be any discrepancy at the end of the month the proper department is notified and the mistake corrected. A record of all the licenses and permits is kept by the comptroller in suitable books, one for licenses and one for permits.

Once a month the various city depositories—the five national banks and three trust companies—certify to the comptroller the cash balance of the treasurer, and this must agree with the balance shown on the books of the comptroller, after making due allowance for any unpaid warrants.

Our day-books and ledgers are in columnar form, whereby we can show at a glance the source of all cash received and the application of the same. This system has been found so simple and practical that by comparing a day-book—say the day-book of receipts—with the debits on our ledger account against the treasurer, we can tell at once whether there is an error in the account. If an error exists, it is soon brought to the surface.

Our books were designed for the purpose of preserving the classification and integrity of the accounts. Every year stands by itself. The only thing that goes over is the balance in the treasury. All appropriation balances lapse at the end of the fiscal year, and the new appropriations cover the estimated expenses of each department for the ensuing year. Of course, there may be transfers from one appropriation to another during the year.

I have referred particularly to the fact that Atlantic City has no warrants outstanding longer than two weeks and no balances of appropriations carried over from one year to another, because a system that is opposed to ours seems to be countenanced by some well known certified public accountant, including Mr. Richard M. Chapman, of New York. With due

respect to Mr. Chapman, I claim that such a system is inadvisable, unnecessary and wrong. It can have no place in the ideal system of municipal accounting. I reject it as I do the proposition advanced by another gentleman, Mr. H. L. Austin, of Catskill, N. Y., attorney and accountant for the New York State Comptroller, who says that the annual interest charges on bonds issued for the building of a schoolhouse, or other public building, should be added to the cost of the building. This is equivalent to saying that a citizen who owns a house, mortgaged for $10,000, on which he pays $500 interest each year, increases the cost of his house at the rate of $500 annually. If Mr. Austin's position is tenable, Atlantic City, with her 6,000 school children and her ten schoolhouses, is about entering upon another public improvement involving a capital outlay of $412,000, for which she will have only a school building worth $160,000. That is, after we have paid for this $160,000 building with the proceeds of bonds, maturing in thirty-five years, we must add to the cost the interest charges of $252,000 during the life of the bonds. Meantime, if we should lease another building, equally as good as the other, our current expense account will be increased annually to the extent of at least $12,000 for rent. In thirty-five years this will amount to $420,000. It is plain enough to me that the item of interest, like the rent, is a charge against current expense. In the one case we pay out $252,000 for interest and have a schoolhouse; in the other, we pay out $420,000 for rent and have nothing in the way of capital asset. As the bonds must be retired at maturity, the sinking fund charge of about $2,500 annually is properly a charge against capital outlay.

[In stating this proposition, opposed to that of Mr. Austin, I do not lose sight of the fact that Mr. Allen R. Foote, of Washington, an author of books on municipal problems, says that interest on investment should be considered an item of cost. I do not understand him to say that this applies to the case of a schoolhouse or city hall, which constitute a capital asset of the city. Mr. Foote apparently refers to money borrowed in

a business enterprise, since he says: "Persons engaged in any kind of business who fail to calculate interest on their investment, as a part of cost, deceive themselves as to the cost of doing business."]

Getting back to the subject of warrants—I assert that it is unwise and unnecessary for a city to issue warrants and register them for payment at some future time—six months or a year, or perhaps five years. To be sure, the warrant is thus converted into a promissory note, instead of a check, but what sense is there in a city issuing promissory notes to meet current expenses? Does a reputable business man issue his check with no funds in bank? Does he write on his script, "This check good six months from date?"

Every well-governed city, if so disposed, can have the cash to pay all bills promptly and can honor all warrants the day they are issued. If for any reason the city hasn't the cash, it can borrow from the banks or brokers, and pledge the anticipated revenue as security for the payment of the notes, bonds or tax levy certificates.

Unfortunately, in most of our American cities the amount of unpaid personal taxes is so large as to cause a scarcity of cash at times. This indicates a faulty system on which the taxes were originally predicated—a system of which Atlantic City is one of the many victims. In this city on September 1st, the delinquent taxes on realty for the last ten years amounted to slightly more than $200,000, and for the same period the unpaid personal taxes amounted to $150,000. In other words, while the *assessed* personal and realty tax is as 1 is to 13, the *unpaid* personal and realty tax is as 1 is to 1⅓. A similar condition exists in other cities, and as most personal taxes are uncollectable after two or three years, it would seem to be a wise plan to wipe the ovedue accounts off the books. They are what we sometimes call "dead horse." The delinquents themselves are mostly "dead beats." [Referring to these taxes, and with a view of remedying present conditions, Comptroller Metz, of New York, said: "It would seem good business policy

to place the assessment on personal property at a proportion of the whole and endeavor to perfect the system of collection so as to assure nearly absolute realization. The aggregate amount of all assessments on personal property may be taken at, say 60 per cent., and the amount resulting from such percentage added to the assessed value of the real estate. On the combined assessment thus obtained the tax rate may be determined."]

Under this method it follows that to whatever extent the collections of personal tax may exceed the assessment taken to predicate the tax rate, the general fund of the city will be benefited and the following year's tax levy correspondingly reduced. [On the subject of personal tax, Mr. Foote says: "That inequalities are permitted to exist can be accounted for only by the fact that good political leaders are poor economists. They have studied taxation problems as questions of political expediency, and not for the purpose of applying true economic principles in a way to remove all injustice. The personal tax would not be retained were it not for the misguided ideas of small property owners that the taxation of personal property is necessary to compel the rich to pay their fair share of taxes. If they could understand that this tax results in putting heavy burdens on small property owners, whose personal property is all in sight, the personal property tax would quickly disappear. Nothing should be taxed that can be driven out of or kept from coming into the jurisdiction of the taxing authority."]

In conclusion, I venture to restate a plan whereby any city may do business advantageously on a cash basis. Every year, after the appropriation ordinance is passed, the governing body, usually the City Council, may authorize the printing of tax levy and license certificates or revenue bonds, equal in amount to the appropriations. Once a week, or once a month, as the cash may be needed for current expenses, the delegated authority, say the finance committee, may sell to the banks or brokers, or to the sinking fund of the city, a sufficient number of certificates to supply the required amount of cash.

This course may be pursued throughout the year, and as the taxes and licenses are paid into the treasury the money, instead of being spent for current expenses, may be used to redeem the certificates.

If such a plan were adopted in Atlantic City, the sinking fund could purchase the entire issue of a million and a half dollars worth of bonds, covering one year's expenditures, and the plan, I am sure, would prove advantageous to the city as well as to the sinking fund.

At the end of the year, if there should be any unredeemed bonds, by reason of unpaid taxes or licenses, the amount of these bonds could be placed in the new budget, or they could be carried as a liability until the anticipated revenue is collected. The first method would add a few cents to the tax rate, but it would have the advantage of retiring the bonds sooner than by waiting for the taxes to be collected.

This plan of raising cash for current expenses also offers an additional safeguard against incurring expenses in excess of appropriations. The total amount of revenue bonds would equal the total appropriations, and the total amount of cash received would also equal the appropriations. When the money is all gone, the appropriations are, of course, exhausted, and the overworked comptroller can then take a rest.

REPORT OF THE COMMITTEE ON REVIEW.

Chairman, C. D. Pollock, Brooklyn, N. Y.

After examining some of the previous reports of Committees on Review which told of sending out over 200 letters requesting items concerning work of special interest and getting only eight replies, and then requesting annual reports and receiving seventeen—many of which were several years old—your committee was discouraged over this experience of others and decided that a trial would be made of watching the current engineering and municipal periodicals for items concerning municipal matters of interest.

A great fault of city reports is the delay in printing the report after the year's work is completed. Another fault is the lack of prominence given to novel features of construction.

During the past year some cities have carried out important improvements while labor and materials have been comparatively low, but others have almost shut down public works just at a time when it would seem to be the best economy to do all the work possible, both from the taxpayers' standpoint and from that of the contractor and laborer.

We will undertake a brief review of important works under subjects telling what various cities are doing which may be of special interest.

BRIDGES.

In Camden, New Jersey, a bascule bridge of reinforced concrete has been erected. Many ornamental features have been brought in here, the concrete adapting itself readily to the architectural lines.

The Wagaraw bridge was built over the Passaic river near Paterson, New Jersey, during the year. This is a 320-foot reinforced concrete bridge of three spans.

In New York City good progress has been made on the Queens Borough bridge from Manhattan over the East River

and Blackwell's Island to Queens Borough. Plans are now being made for the official opening of this bridge at an early date.

The Manhattan bridge, from Manhattan to Brooklyn, is taking shape. The steel towers have been completed and the work of spinning the cables is progressing, the promise having been made that the cables will be completed by the first of the year 1909, and the entire bridge in eighteen months. This will be remarkable speed for so large a structure.

Cincinnati, Ohio, has recently completed the Harrison avenue viaduct. It is about 1,800 feet long with a width of fifty-five feet. This carries a thirty-six-foot roadway, two sidewalks and two cartracks over Mill Creek, several streets and railroads. An important feature is the 180-foot deck span over the creek.

PAVEMENTS.

A municipal asphalt plant has been built for Toronto, Ontario, by the Warren Asphalt Paving Company of Boston. The contract price was $28,575. The capacity of the plant is 1,500 square yards per day of nine hours. Mr. Charles H. Rust, City Engineer, and Past President of this Society, has described this plant in a report.

The City of Springfield, Massachusetts, has built reinforced concrete pockets or bins at a cost of about $8,000 to facilitate the storing and handling of broken stone for use in repairing their macadam pavements.

In New Jersey, Governor Fort has recently advocated a highway sixty feet wide, from Sandy Hook to Cape May, a distance of about 127 miles. The estimated cost is $400,000, and the Governor favors making it a State expense.

The Long Island Motor Parkway, nine miles long, was built this summer, using the Hassam Paving Company's grout mixer to mix the grout for the pavement.

A new form of pavement foundation is being tried in Hartford, Connecticut, on some of the railroad streets. The street is excavated under the tracks, a six-inch layer of concrete is

placed and carried up on the edges of the excavation, making a long, shallow trench, which is filled with broken stone. At the center a one-half tile drain is placed. Then treated ties are tamped in the broken stone and the latter is brought up to within three inches of the finished crown of street. Then a one and one-half-inch layer of Portland cement contrete is put on, and last a concrete with asphaltic cement. It is thought this will make a permanent construction and repairs can be made easily in the broken stone under the three inches of pavement.

SEWERS, DISPOSAL PLANTS.

Baltimore has begun erecting a sewage pumping station, for which the contract price for building and pumping engines is $748,955. Work has been continued upon the sewerage system, disposal plant, etc.

In Gary, Indiana, in constructing a main sewer which was about thirty feet below the natural ground with the ground water only six to seven feet below the ground level, a novel method was employed. The ground was a fine sand. A row of wells was driven on either side of the trench and the ground water lowered by pumping.

A reinforced concrete pipe trestle has been built in Los Angeles, California, to carry an intercepting sewer across the Los Angeles river.

In Wilmington, Delaware, reinforced concrete pipe sewers are being laid. The pipe is made in molds in three-foot lengths and then laid in trench.

In St. Louis the second section of about 3,000 feet of the Harlem Creek sewer is being built. This has a flat arch invert and the arch is circular, having a twenty-five-foot span and a rise of seventeen feet.

STREET CLEANING, REFUSE, AND GARBAGE DISPOSAL.

Seattle, Washington, has installed a refuse destructor of the Meldrum type. The total cost of plant, exclusive of ground, was $36,134.50. Over 1,700 tons of refuse per month were

burned during June, July, and August, 1908, at a cost varying from 71 cents to 79 cents per ton for labor, the average being about 75 cents.

On December 31, 1907, a commission consisting of Messrs. H. deB. Parsons, Rudolph Hering and Samuel Whinery, made an exhaustive report to the Mayor of New York City upon Street Cleaning and Waste Disposal in New York City. The commission's conclusion is that flushing combined with hand sweeping is the best and cheapest method for properly cleaning New York's street pavements.

For snow removal they recommend letting the work by contract and paying for the area cleaned by the depth of snow fall.

In the Boroughs of Manhattan, the Bronx and Brooklyn, the commission recommends the reduction of the garbage and dead animals by contract until further experience has been had with high temperature incineration furnaces, but advises the latter for the Boroughs of Richmond and Queens.

At Oak Park, Illinois, a forty-ton garbage incinerator has been built; also a new incinerator in the Borough of Richmond, New York City.

TUNNELS, ELEVATED RAILROADS, ETC.

The Brooklyn extension of the New York subway was opened on May 1, 1908. This is the extension from the Battery under the East river, and up Joralemon street, Fulton street, and Flatbush avenue, Brooklyn, to the Long Island railroad station. This has done much to reduce the crowds during rush hours on the Brooklyn bridge.

The Hudson Company's tunnel from Manhattan Borough, New York City, under the North river, to Hoboken, New Jersey, has also been opened and affords material relief to many who live in New Jersey and work in New York City.

Plans have been submitted for a proposed freight subway on West street, New York, to have a depth of about eight and one-half feet.

In Philadelphia the Transit Company is making good progress in constructing the Market street subway. This work was started in July, 1906.

Chicago has been considering the building of subways for surface cars.

The Pennsylvania railroad tunnels in New York City are nearing completion and are promised for May of next year.

In Boston the Washington street subway has been completed, except for a small amount of work about some of the stations.

Many different problems were encountered here because of the narrow street and in many cases it was necessary to carry the work on under large buildings.

WATER SUPPLIES, ETC.

The Louisville Water Company of Louisville, Kentucky, has built a very high water tank, 50 feet in diameter and 220 feet high. This tank is supported on a 155-foot high steel tower.

The main dam of the Croton Falls reservoir is progressing rapidly. It is now about half completed in cost. The total cost of the contract for this addition to the storage supply for New York City will be about three and a quarter millions.

Numerous contracts have been let by the Board of Water Supply of New York City for the additional supply to be obtained from the Catskill region—the largest being that for the construction of the great Ashokan reservoir, for which the contract price is about $12,660,000.

In Chicago the new Blue Island Avenue water tunnel is being driven. This is about 28,000 feet in length and eight feet in diameter, and is to connect two of the pumping stations. It is to take the place of the present tunnel which does not follow street lines and is liable to damage from driving foundation piles for buildings. The new tunnel follows the streets as now laid out.

A small concrete dam at Hot Springs, South Dakota, was

built for the water company, which was remarkable for cheapness and the speed with which it was built.

Lynchburg, Virginia, has built a new dam for the water supply of concrete blocks. The dam is seventy feet above rock foundation and was built with such care that there is practically no seepage.

Brooklyn seems to have the record for number of complaints of eels in water pipes. In one day the Water Department received sixty-eight such complaints. Attempts have been made to remedy this trouble by flushing the eels out through the fire hydrants at night when the pressure is greatest.

Nashville, Tennessee, is clarifying the water supply by applying a coagulant in a large reservoir. The reservoir has a capacity of 51,000,000 gallons, and as the normal consumption is 15,000,000 gallons per day, the period of sedimentation is three days.

Halifax makes a practice of scraping the water mains about twice each year. One low service twenty-four-inch main, 13,400 feet long, has been cleaned annually for over twenty-five years at an average cost of $15.07 for each scraping.

Pittsburg, Pennsylvania, has been trying scraping water mains. The increase in discharge was found to vary from 64 per cent. to 564 per cent., depending upon how dirty the pipes were before cleaning.

In closing, we would suggest that if the members of this Society would be careful to write a brief memorandum of any novel feature of work done by them and transmit these promptly to the Secretary, your Committee on Review would have better and fresher material for the report, and also the Society's clearing house of useful information would be better supplied with facts.

Then, again, if reports can be gotten to and from the printer more promptly another source of reliable information would be more useful to your committee.

DISCUSSION.

Mr. Tribus: I should like to call attention to something Mr. Pollock didn't get hold of, and which hasn't yet been published, that might interest the members if they are coming through New York again. A large retaining wall of absolutely novel type is being built in the Borough of Richmond, near St. George Ferry. It is of reinforced concrete, in which there is a steel wall so locked together with steel rods that it is self-sustaining; it carries all the molds for the concrete itself, and the concrete is simply a facing, an inclosing medium to protect the steel. It ranges in height from twenty to forty feet, and is something like 4,000 feet in length. It is well worth a visit from any one interested along these lines.

The President: Mr. Tribus' remarks accentuate what Mr. Pollock says of the value of members communicating to the Secretary anything novel that may come to their notice. As Mr. Tribus has been a member of the Society less than twenty-four hours, however, we cannot charge it up to him this time.

JOINT CONSTRUCTION AND OPERATION OF SEWERAGE WORKS—THE DRAINAGE DISTRICT AS DISTINCT FROM THE MUNICIPALITY.

REPORT OF THE COMMITTEE ON SEWERAGE AND SANITATION.

Chairman, E. S. Rankin, Engineer of Sewers and Drainage, Newark, N. J.

At a recent convention of this Society a paper was read describing the so-called sewerage system of a city in the middle west. The paper aroused considerable interest as a good description of the wrong way to sewer a city. It seems that in that city any neighborhood or block, regardless of contour, desiring a sewer, could, by the petition of ten residents, have commissioners appointed, who in turn could engage an engineer and a sewer would be built for that particular neighborhood, or "Improvement District," as it was called. This sewer would be built to provide for this district only, without regard to any further extensions, and at the date on which the paper was written the people had begun to realize the fact that it would soon be necessary to rebuild all these sewers on some systematic plan. This is, of course, an aggravated case, but in many, probably most of the older cities of the country, examples can be found where sewers have been built to provide for the present necessities only, without regard to future extensions.

The general introduction of the separate system marked a new era in sewer building in this country.

The enormous reduction in the cost of a sewer for house sewage only, as compared with a combined system, made it financially possible for small towns to build complete systems of sewers, which otherwise would have been obliged to defer the whole matter, or build only in those sections where sewers were most needed, with a tendency to cheap construction and without proper regard for future needs. So that the separate system is responsible not only for more sanitary conditions, but

for more comprehenhive plans, and for the past twenty years most cities and towns which have constructed sewers have build on broad lines embracing the whole of the municipality. This was a long step in advance, but it is becoming evident that still further progress is necessary along the same lines.

In these days of consolidation, old boundary lines are being abolished, and what was once two or more municipalities, may now be one. Suppose a town has adopted a modern and comprehensive plan for its entire area and built its main outfall sewer and a large part of its branches; now suppose it annexes a suburb lying on a higher level and extends its sewers through this new section; suppose this process is repeated, as is constantly done, it will not be long before conditions are no better than those of the older cities. Of course, the obvious solution is for the original town to build large enough for the entire drainage area. But in how many cases is this done? Would the average taxpayer consent or would the average town council or committee or board of works consent to go to a larger expense than necessary in order to take care of a neighboring town, perhaps a rival, whose annexation may occur in some indefinite future?

Another feature of the problem which is coming more rapidly to the front each year is the growing sentiment against the pollution of rivers, and in favor of some form of sewage purification.

A river into which is discharged the crude sewage from a number of growing cities along its banks will in time become a public nuisance and a menace to the health of the whole community. Sewerage works, whether disposal plants or long outfalls to the sea, are costly luxuries at best, and it would seem as if the rational solution in all cases would be a consolidation of interests, involving more or less State supervision and the construction of all future sewers with reference to natural drainage areas, ignoring artificial political boundaries. The object of this report is to show what progress has been made along these lines.

In order to obtain all the information possible on the subject and in the belief that the authority for any such combination must be obtained from the State Legislature, the following questions were addressed to each Secretary of State throughout the country, advantage being taken of the Society's "Clearing House of Information," which our Secretary kindly put at my disposal:

1. Are there any laws in your State permitting two or more municipalities to unite in the construction of sewerage systems?

2. On what basis is the cost of construction divided?

3. On what basis the cost of maintenance?

4. What board or commission has control of the work, and how is it appointed?

5. If possible, please send a copy of the laws bearing on such matters.

Letters were also sent to members of this Society in a number of the older States, and from these sources and such information as could be obtained directly by the writer, the following summary, with brief descriptions of governing laws and examples of such combinations are submitted:

States from which no replies were received: Arkansas, Florida, Georgia, Idaho, Indiana, Louisiana, Nebraska, Nevada, North Dakota, South Dakota, South Carolina, Tennessee, Utah, Washington, West Virginia—15.

States in which the first question was answered in the negative: Arizona, Colorado, Connecticut, Delaware, Iowa, Kentucky, Maine, Michigan, Minnesota, Missouri, Mississippi, Montana, New Mexico, Oklahoma, Oregon, Texas, Vermont, Wisconsin—18.

Doubtful States, letters answered but without definite information: Maryland, New Hampshire, Virginia, Wyoming—4.

States in which laws or examples of joint sewers were found: Alabama, California, Illinois, Kansas, Massachusetts, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island—11,

Alabama—In Alabama, city and town councils have authority to extend sewer mains wherever in their opinion it may be necessary, to any point in the county in which said city or town is situated. This is a step in the right direction, but the authority should be extended to cover any points within the watershed. Jefferson County, in which the City of Birmingham is situated, has a county system authorized by a special act of Legislature. Thirteen distinct cities and towns are drained by this system, both the first cost and maintenance of which are paid for by the county at large through the issue of bonds, although but little more than half the population of the county is reached by the system. This, of course, places both construction and maintenance on the basis of ratables.

California has on its statute books a rather peculiar law which should hardly be included in this report, but which is mentioned as a curiosity. This act provides that on the petition of one-third of the resident electors of any described district, the Board of County Supervisors shall form the same into a sewerage district, unless after due publication a protest is filed by the owners of a majority of the taxable property within such district. (Note that no mention is made of the size, shape or contour of the proposed district.)

The district being so formed, they may proceed to construct and maintain sewers therein and compel property owners to connect therewith.

"Whenever a sewerage district shall be so formed of territory adjacent to any municipality having a sewerage system, the sewerage system of said sewerage district must be connected with and have its outlet through the sewerage system of said municipality." (It is not stated what would happen if the municipality should lie on a higher level than the proposed sewerage district.) Consent must, however, first be obtained from the municipality and a price for the use of the sewerage system determined by its legislative body. This money is to be raised by a special tax on the sewerage district and paid annually to the municipality.

It is worthy of note that this law became operative without the signature of the governor.

Illinois—In Illinois any two or more towns within the same county desiring to unite in the construction of sewerage systems may do so by publishing the necessary notices, ordinances, etc. One of the petitioning towns is designated by the court to conduct all the proceedings, and its Board of Local Improvement has the power to make contracts, issue bonds, superintend the construction, etc., in the name of such designated town in accordance with the general laws governing the construction of sewers. Assessments are levied for benefits received throughout the whole district, and are collected by the proper financial officer within each town participating in the improvement and by him turned over to the town designated as above, which in turn pays the moneys to such parties as may be entitled thereto. If the county, as well as the town lines could be eliminated, this would seem to be a very satisfactory arrangement.

Kansas—There is a proviso in the Kansas drainage law permitting two drainage districts to unite in the construction of drainage canals. This does not strictly come within the scope of this report and no details have been obtained.

Massachusetts—The oldest and largest example of such combining of municipalities in this country is the Massachusetts Metropolitan Sewerage District, formed in 1889 to prevent the growing pollution of Boston harbor and its tributary streams and for the protection of the water supply. The report of the commissioners for 1908 gives for the two districts, known as North and South, a total area of 191.37 square miles, comprising twenty-five distinct municipalities with a total population in 1905 of 823,730. The sewerage of this entire section, as well as the water supply, is under the control of three commissioners appointed by the Governor. The cost of the work was assessed on the several municipalities on the basis of ratables, and the maintenance on the basis of population.

New Jersey—There are several examples of joint construction in New Jersey. One of the most comprehensive schemes

of the kind in the country, in fact the largest so far as the writer has been able to learn outside of the Metropolitan System of Boston, is the proposed plan to purify the Passaic river by the construction of a trunk sewer from Paterson to New York bay, draining what is known as the Passaic Valley Sewerage District.

The area included within this district contains 76.62 square miles, comprising the whole or part of twenty distinct municipalities in four different counties, with a total population in 1905 of 572,200.

The history of this project is given in detail in the Proceedings of this Society for 1904. Briefly the act provides that all pollution of the river must cease by December 12, 1912, and authorizes but does not compel any two or more of the municipalities now discharging into the river to enter into a contract with each other and with the Passaic Valley Sewerage Commission, to construct and maintain an intercepting sewer and necessary appurtenances in accordance with the plans prepared by the commission.

"The cost of the construction shall be apportioned to the respective municipalities entering into the contract in such proportion as the taxable property, real and personal, within so much of that municipality so contracting as is embraced in said sewerage district, bears to the total amount of taxable property within so much of all the municipalities so contracting as is embraced within said sewerage district for the year 1907."

The cost of maintenance, repair and operation shall be apportioned annually according to the amount of sewage respectively contributed.

The commission in charge of the work is appointed by the Governor.

At the present writing a majority of the municipalities interested have signified their willingness to enter into such a contract.

Another example of joint ownership in New Jersey is what is known as the Joint Outlet Sewer, discharging the sewage

from seven distinct municipalities in two counties into tide-water. An area of about sixty-six square miles is provided for with a present population of about 50,000. This work was done under the direction of a committee of seven, one appointed by each town.

In apportioning the cost an attempt was made to estimate the final amount of sewage to be contributed by each municipality, consideration being given to the physical characteristics of each, its estimated ultimate population and water supply. The location of the several towns was also a factor in the apportionment, those lying nearer the outlet paying less proportionately than those at the upper end. In other words, each town paid for so much of the sewer as it actually expected to use. As the action of the several towns in joining in the project was purely voluntary, this method was evidently satisfactory to all. The capacity allotted to each is its actual property and may be disposed of in whole or in part if desired to other communities desiring to use this sewer. The cost of maintenance is shared equally by all.

About twenty years ago Orange, Bloomfield and Montclair, all in Essex County, N. J., united in the construction of an outlet to the Passaic river. The cost was divided on the basis of the estimated population thirty years in advance.

At the present writing the City of Plainfield, with four or five neighboring towns having a total population of about 35,000, are considering the advisability of a joint trunk sewer to tidewater. Details as to apportionment, etc., have not yet been worked out.

The City of Newark is at present building a system of sewers in which provision is made to take the sewage from parts of Bloomfield and East Orange. These places have agreed to pay a portion of the cost of construction, based on the relative areas to be drained in the three municipalities, and also to pay a proportionate share of the cost of operation, based on the amount of sewage contributed.

New York—The Village Laws of the State of New York provide that the Board of Sewer Commissioners of any village, may contract for the connecting of the sewers thereof with the sewers of another village, town or city, or jointly with such other village, town or city, construct, maintain, operate or use sewers, outlets or disposal works.

What is known as the West Side Trunk Sewer in the City of Rochester, N. Y., drains also a portion of the Town of Gates. This work was under the control of a board of three members appointed by the County Judge, and was assessed on all property benefited the same as a strictly local improvement.

The Bronx Valley Trunk Sewer, now being constructed, to drain the whole or part of six cities and towns in the County of Westchester, N. Y., is under the control of three commissioners, appointed by the legislature. The present population of the 34 square miles in the district is about 25,000. Both first cost and maintenance are to be paid for by the issue of county bonds, the interest and the sinking fund of which are assessed on the property benefited on the basis of its assessed valuation.

North Carolina—The main outfall sewer of the Town of Winston, N. C., runs through the Town of Salem. Salem secured the rights of way for the sewer and agreed to pay an arbitrary fixed sum for the use of the sewer when its own sewers were built.

Ohio—An Ohio law gives authority to the councils of two or more municipalities to provide for the construction of a main sewer and branches jointly; to agree upon the plans and portion of the cost to be paid by each.

Pennsylvania—I am informed by the Secretary of State of Pennsylvania that there are numerous laws in that state bearing on this subject, and several instances of joint ownership, but in the limited time remaining it was impossible to locate them.

Rhode Island—The City of Pawtucket, R. I., has recently received authority from the legislature to enter into a contract with Providence for the disposal of part of its sewage. It is proposed to pay to the City of Providence a certain sum per 1,000,000 gallons of the sewage treated, plus a fixed annual charge as interest on the cost of the main sewer within the City of Providence to the Pawtucket line; this interest charge to be that portion of the total interest on the cost of this trunk sewer which the territory drained by the Pawtucket sewers discharging into it bears to the territory drained within the limits of the City of Providence. This places the apportionment of the cost of construction on the basis of area, and of the cost of maintenance on the basis of volume of sewage contributed.

While there are doubtless other examples of joint ownership in the country, the above give a fair idea of what has been done and show sufficient variety to form an interesting basis of comparison. Tabulating those which give definite information we have for the three questions of supervision, apportionment of cost of construction, and cost of maintenance:

SUMMARY OF ABOVE DATA CONCERNING JOINT SEWER CONSTRUCTION.

SUPERVISION.

Joint sewerage under control of the governing body of one of the contracting towns	4
Commission appointed by governor	2
Commission appointed by legislature	1
Commision appointed by court	1
County authorities	1
Commission consisting of one member chosen from each town	1

COST OF CONSTRUCTION.

Apportioned on basis of ratables	5
Apportioned on basis of area	2
By direct assessment on property benefited	2
Apportioned on estimated population in thirty years	1
Apportioned on estimated actual ultimate use of sewer	1

COST OF MAINTENANCE.

Apportioned on basis of ratables	4
Apportioned on actual sewage contributed	3
Apportioned on basis of population	1
Divided equally	1

Of these three questions, the second, "How shall the cost be apportioned?" is the one liable to provoke the most discussion. The main difficulty arises from the fact that sewers are not built for the present only, but for the future; hence population, the basis recommended by the Boston Commission of 1885, would seem to be unfair, as one community may grow much more rapidly than another in the same vicinity. This is well illustrated by the case of two towns in the Massachusetts Metropolitan District, both having practically the same population, about 6,000, in 1875. Thirty years later, one had increased 132 per cent. and the other 258 per cent. Two other towns in the same district, with a population of about 21,000 each, in 1875, had increased in the thirty years 81 per cent. and 221 per cent., respectively. Again, equal populations may contribute an unequal volume of sewage, depending on the abundance of the water supply, or the amount of ground water allowed to enter the sewers. Apportionment by estimated future population does away with the first objection, but introduces the uncertain factor of the estimate.

The basis of area has the advantage of remaining unchanged when once determined, but why should an area unsuitable for habitation be placed on the same footing with one capable of supporting a large population?

Direct assessment on the property benefited solves the problem satisfactorily in those cases where it can be done, but would be a cumbersome method where a large number of towns were involved, besides placing the whole burden on the property owner at once, instead of distributing it by means of long term bonds.

The favorite basis seems to be that of ratables. This method has the advantage of being easily determined and

easily understood; at the same time it is open to serious criticism. Boards of Assessors in different cities sometimes have very different ideas as to valuations. They may be kept high in order to reduce the tax rate; they might be kept low in order to reduce the assessment for the joint sewer. Ou this basis a suburb inhabited by a wealthy community, with costly residences, while less thickly populated than its neighboring town, occupied largely by a poorer class, and contributing much less sewage to the main outfall, is yet required to pay a higher price for the privilege; for after all is said, is not the volume of sewage entering from each town, or the actual use made of the sewer, the true basis of apportionment? The same question of the future also comes in, it being extremely improbable that the ratables of all the towns would remain in the same relative proportion.

For the purpose of comparison, I have computed the percentage of the total estimated cost of the proposed Passaic Valley Sewer chargeable to the City of Newark, on several different bases, with the following results. All figures are taken from the report of the commission, recently published:

Ratables (the basis fixed by act of legislature)	52%
Population, 1905	48%
Population (estimated), 1940	31%
Area	15%
Volume of Contributed Sewage (estimated), 1940	28%

Assuming that the sewage contributed is the true basis of apportionment, the City of Newark, by law, is required to pay nearly double its just share of the cost of this work.

If this assumption is correct, there still remains the problem of determining what this volume of sewage would be. Careful study would be required for each case, and even then the personal equation must of necessity be a prominent factor.

The following has suggested itself as a possible solution of the question: After the boundaries of the district have been determined, let it be incorporated by the state as a

sewerage district, under the control of a commission who shall have authority not only to design and construct the sewers, but also to issue bonds to cover the cost of the work. The interest and sinking fund on these bonds to be paid by the municipalities within the district, in the proportion of the volume of sewage which each contributes. These charges would, of course, vary from year to year and would have the tendency to encourage the construction of watertight sewers and to discourage the waste of water.

From the study of the subject the writer is of the opinion that such combinations of municipalities should be encouraged on the grounds of health and economy; that so far as possible the details of such combination should be left to the municipalities interested, but that a certain amount of state supervision is advisable in order to secure comprehensive plans and compel action when necessary; that the apportionment of the cost should be as nearly as possible for benefits actually received, and finally that the cost of maintenance and operation should be on the basis of sewage actually contributed, varying from year to year, as determined by gauging.

DISCUSSION.

Mr. Brown, of Indianapolis: I believe Mr. Rankin put Indiana in the list of those which had not replied to his request for information, which was probably because there are no laws on this subject in the State. There is an instance where the joint construction was carried out without reference to any law. Woodruff Place is a town entirely surrounded by the City of Indianapolis, and must sewer through that city. When the city constructed the main sewer, into which Woodruff Place must drain, the Board of Trustees of Woodruff Place made a contract with the city to pay a proportion of the cost. According to the laws of the State, the assessment for sewers is made in two parts; one is the local assessment for the service to the property abutting the sewer, and the other is the district assessment for the service of the sewer as an outlet for the sewage and drainage of the entire district. This district assessment is made upon all of the territory within the drainage district of the sewer,

and strictly speaking, if Woodruff Place had been a part of the city, it would have received only the district assessment, because its local sewers were not constructed. But the main sewer for which they helped to pay discharged into another main sewer, which discharged into a third, and so on, so that in that case the Woodruff Place property would have had perhaps five or six district assessments. Therefore, in order to equalize matters, the contract called for the payment by the Town of Woodruff Place to the city of an amount equal to the sum of both the district and local assessments. While there was no law governing the case, there was no difficulty about making this sort of settlement, and I see no reason why a similar process could not be applied in the case of any other two corporations in the State under similar conditions.

MR. RANKIN: I would state, Mr. President, that several of my replies were very unsatisfactory. In some instances they replied that there were no laws, where upon investigation, I found there were such laws.

MR. RUST: We have had only one instance in Canada covered by the circumstances described by Mr. Rankin. The town of West Toronto constructed a system of sewers some time ago and applied to Toronto for an outlet, and after a good deal of correspondence, they made a contract by which the City of West Toronto pays three cents per lineal foot of sewers for every foot which connects with the Toronto sewers.

THE PRESIDENT: Is that perpetual?

MR. RUST: Yes, it is perpetual.

REPORT OF COMMITTEE ON WATER-WORKS AND WATER SUPPLY.

Chairman, J. L. Ludlow, Winston-Salem, N. C.

The Chairman of the Committee on Water-Works and Water Supply would report that during the past two years, since the last report of this committee was submitted, there has been no diminution in the popular appreciation of public water supplies as an important function of municipal equipment and of municipal life. On the other hand, there is abundant evidence of a continually increasing realization in the popular mind of the necessity of such an adjunct as an essential condition to promote life, health and comfort in all congested groups of human habitations. This seems particularly true of the people residing in the smaller towns and cities of the United States, and as a consequence there have been during the past two years, in spite of the general financial and industrial depression that has prevailed, a very large number of small water-works plants established throughout all sections of the country; notably in the South, the West and the Southwest.

A review of the activities in this branch of municipal equipment presents, among the most important undertakings, the great work of developing an additional water supply for the City of New York from the Catskill Mountain district, from which source it is intended to increase the daily supply available to the city, by 600,000,000 gallons. This project, including the great dams for impounding reservoirs and the great tunnels and aqueducts, and with the length and capacity of the supply conduit, is the most monumental undertaking in the field of public water supply in this country.

Other notable works include the new water-works system now nearing completion for the City of New Orleans, La., where the supply is to be taken from the Mississippi River, purified and softened and delivered to the city at the rate of 40,000,000 gallons per day. The projects for new supplies at Los Angeles, Cal.; Oakland, Cal.; Springfield, Mass.; Gary,

Ind., and Salt Lake City, Utah, are also included in the more important ones.

With the modern tall buildings in cities, and the intense congestion that modern business conditions have brought about, a new problem in water-works plants has but recently arisen, which calls for a general increase of the pressure under which the water is supplied, as well as making it possible to secure a much greater volume at any given point, for use in preventing serious conflagrations. That this will call for a general increase in the average size and strength of the pipes composing distribution systems, now appears probable. In the largest cities the problem is being met by providing special high pressure systems in the most congested districts. Such plants have recently been completed in New York, Brooklyn, Philadelphia, and projected for San Francisco, Cal., and Hartford, Conn.

The question of wherein shall be vested the ownership of municipal water supplies appears at this time to have been quite generally decided in favor of public vs. private ownership. This decision appears to have become so thoroughly settled in the public mind that projects for private ownership of municipal water-works have become quite rare, and the securities based upon such undertakings no longer meet the favor of investors that was so freely granted them a few years ago. All the signs of the times indicate this to be a permanent settlement of the question that gave rise to so much discussion but a few years ago.

With the increased cost of furnishing water, due to the demand for a more pure and wholesome quality, additional importance has become attached to the problem of waste prevention and limiting the quantity to be purified and supplied to the legitimate and reasonably necessary uses. This has given rise to a greatly increased use of water meters and to investigations of abnormal leakage in pipe distribution systems and service connections, with resulting economy in the cost of maintaining and operating water-works plants, and the actual cost of water to the consumers. A study of the cause of

excessive leakage in pipe joints and a remedy therefor offers an inviting field of investigation.

In the movement to secure a more satisfactory and wholesome water supply, there has been continued activity throughout the country and much has been accomplished and projected during the past two years.

Filtration is to be a feature of the great Catskill project. Plans are in progress for the filtration of the Croton supply. The filtration plant for the City of Philadelphia is nearing completion. The Pittsburg filtration works has been but recently completed and put in operation; likewise, the filtration works at Cincinnati, O. And at New Orleans, the purification works is nearing completion. Other important current filtration projects include Oakland, Cal.; Fostoria, O.; Wilmington, Del., and Lancaster, Pa.

The desirability and importance of removing the hardness that is normal to the available public water supplies in various parts of the country, is likewise receiving increased attention, and being given credit for the importance attaching to this feature of public water supplies. Among the larger water softening plants now in progress and nearing completion, are found New Orleans, with a capacity of 40,000,000 gallons daily; Columbus, O., with a capacity of 40,000,000 gallons daily, and McKeesport, Pa., with a capacity of 10,000,000 gallons daily.

In connection with the problem of water purification, much progress is being made in matters of details of filter plants, to secure a higher and more reliable degree of purity at more economic cost, both of plant and of operation. The art of the engineer, the chemist and the bacteriologist are being brought together in the design of purification works, to meet the peculiar conditions and characteristics of the particular water that would be purified, so that filter plants may not partake of the appearance of stereotyped plans, regardless of the work to be accomplished with different waters, but the plant may be designed and built, and its operation conducted to meet the

peculiar conditions of each case. This is even more true of the provision for and methods of preliminary treatment, and in the selection of the amount and character of coagulant, before the water is applied to the filter to undergo the last operation in the process of treatment and purification. Much valuable information, both general and specific, is to be expected from the continuation of the practice and study through experimental plants that will lead to greater efficiency and greater economy in the problem of water purification for public supplies. An interesting experiment in this connection is that being practiced at the comparatively new Harrisburg, Pa., filter plant, where an artificial turbidity is being created as an aid to filtration. The same treatment is being practiced at Reading, Mass., where filtration is employed for the purpose of iron removal.

Much has been learned of suitable means for preventing algae growths in impounded waters, and the knowledge gained of the efficacy of sulphate of copper as a suitable agency to prevent such growths and the conditions resulting therefrom.

Further progress has been made in the study of other methods of treatment and purification of public water supplies; notably, the ozone treatment, the use of hypo-chlorite of lime for sterilizing purposes, and double filtration, all of which add to the sum total of knowledge that is useful and essential to the proper solution of the engineer's problems relating to public water supplies.

The problem relating to the stripping of reservoir sites, which was presented as an important feature of the report of this committee two years ago, in a paper by Mr. Julian Griggs, then chairman, has received new attention and consideration. The importance of stripping proposed reservoir basins, as a step in the process of rendering a stored supply suitable for public use and consumption, and the relative economy of reservoir stripping vs. more complete filtration, has been an important study in the minds of engineers during the past two years. Much has been added to the literature on the subject;

notably, the interesting and exhaustive report on the subject in connection with the Catskill project, made by Mr. George W. Fuller, a member of this committee, and Mr. Allen Hazen.

The matter of protecting the sources of public water supplies has received marked attention during the past two years, and much progress has been made in this line of endeavor, which is considered to be a work of great importance by those associated with the public water supply problems. Development and progress along this line of endeavor can only be accomplished through a recognition, on the part of the public, of its importance. That there is in force a marked increase in the public conception of the importance of this subject, is manifest in the recent laws that have been passed by the legislatures of several of the states, looking to the prevention of stream pollution and the perfecting of the machinery for the execution of such laws; the new laws as well as the older ones, which have been in the statute books for several years but have been very indifferently observed or executed. A noted instance of the growing sentiment on the part of the public is reflected in the recent recognition of the importance of maintaing the purity of our streams and rivers, in the general scheme and movement for the conservation of our natural resources. That this movement is destined to grow and spread rapidly, there appears now to be no question. Its important relation to the problem of public water-works and water supplies cannot be overlooked by those interested in municipal growth and improvements, and the provision of suitable conditions for the promotion of life, health and happiness for those who would, or must, dwell in thickly congested towns and cities.

That the engineers who are devoting their time and talents to a proper solution of the manifold problems of city life will continue in the forefront of the agitations for improvements and reforms, there can be no doubt. That they will also be able to wisely and economically spend all the appopriations that the public will permit or tolerate, may likewise be safely relied on.

IMPORTANCE OF THE PROPER OPERATION OF WATER AND SEWAGE PURIFICATION PLANTS.

By George W. Fuller, New York City.

When a man buys a good watch, a good horse or a good automobile, he usually expects to take good care of them in order to receive satisfactory service. If he seriously neglects or abuses them, he generally expects to receive, and ordinarily does receive, poor service.

A comparison of this type of personal property with purification plants for municipal service offers considerable room for parallelism. For some time purification plants have been designed with an increasing tendency to make them "foolproof." Notwithstanding this endeavor on the part of designers, it is quite feasible with a well designed and well built purification plant to obtain poor service through improper operation. Unfortunately, there are far too many poorly operated purification plants in this country today. The purpose of this brief paper is to outline some of the more salient features of this proposition in order to keep its importance clearly in the minds of public officials in the hope of securing a higher grade of operation.

In the early years of water purification plants in this country many of them were such in name only. With the advent of the germ theory of disease and the extended investigations at Lawrence, Louisville, Pittsburg, Cincinnati, etc., there became available a considerable fund of information which served the double purpose of accentuating the importance of proper maintenance, and at the same time of affording a clearer conception of what was needed, both as to design and operation in order to secure satisfactory results.

The larger plants for purifying water have practically without exception been provided with laboratory equipment and with a staff of attendants capable of operating the works

to good advantage. It is not the intention to criticise, but on the contrary, to commend this feature of the more important purification plants in this country, and to urge greater attention on the part of smaller communities to what has been done by the larger cities with much benefit to themselves.

The importance of such operation is constantly increasing, since there is clearly a desire on the part of municipalities to secure a good public water supply, although the water at its source may be a difficult one to treat in many ways. A few years ago water filtration and water purification were almost synonymous. With developments in the South and Central West, the coagulation of waters heavily laden with clay has become perhaps as important a matter as filtration itself, and frequently the coagulant department needs more attention than the filters. Softening of extremely hard waters is another important step in advance from the viewpoint of the consumer, and adds materially to the importance of high grade maintenance in order to secure satisfactory results. This is particularly true where the water to be softened is taken from surface sources subject to quite wide variations in quality at different seasons of the year, as is the case of the large water softening plant recently put in service at Columbus, Ohio.

Combinations of water softening and coagulation in conjunction with filtration are also a feature accentuating the point under discussion. This feature is encountered in the Columbus plant, and is expected to be availed of to a still greater degree at the large water purification plant now approaching completion at New Orleans. It is thus seen that with the modern plant there is not only great need of competent management for the sake of efficiency, but there is also such need in order to guard against needless cost for supplies. In some cases it is quite possible with good supervision, both to filter and soften a water at less expense than to filter alone with ordinary management.

In Europe water purification plants in the larger cities have been carefully operated, generally under more or less

supervision from a branch of the general government, and the results on the whole have been quite satisfactory. It required the severe epidemic of cholera at Hamburg fifteen years ago in order to emphasize the importance of careful operation. It is the writer's belief that the smaller purification plants in Europe are better operated than are most of the smaller plants in this country. Directly or indirectly, this is due in considerable measure to the influence of the supervising authority and the desire on the part of the local authorities to produce results meeting with favor and not with criticism on the part of the higher authorities, who record and publish at intervals the general status of various purification plants. This supervising authority operates to best advantage when it insists upon a proper end result and when it does not interfere with details of administration which belong to the municipal government or private water company. The latter can be taught under such supervision sooner or later to take a pride in their project, and data can be secured which will lead them to make improvements and modifications with decided benefit to themselves.

From the standpoint of the water consumer, authorities in charge of water filter plants in America ought to satisfy reasonable requirements of a supervising State authority, who would have a general oversight over the efficiency of operations. The means of securing this end should lie in the hands of the local authorities, and the latter should be stimulated and assisted rather than criticised by the State authorities. The main object to be attained is that of getting safe and satisfactory filtered water at minimum expense. No good is accomplished by having various persons in authority quibbling over technical details. It is the spirit of co-operation which is needed and which will make the citizens feel that they are securing a satisfactory product without waste of money.

The writer believes that it is highly important for the members of this Society to strive for the result above outlined. If the citizens of a community do not feel that their public

water supply is satisfactory it is usually possible by a campaign of education to overcome such ideas when they are based upon ignorance or caprice. Water consumers have a right to expect a water satisfactory as to appearance, taste and odors. Regardless of its hygienic quality, they will largely judge a supply by what they see themselves. For this reason the writer believes that water purification should mean not only the removal of disease-producing bacteria, but also objectionable turbidity, color, tastes and odors.

The construction and maintenance of plants capable of affording the above results can be provided for practically any water supply. Their cost is ordinarily quite reasonable in amount, and when viewed in the light of value received, the expense may be called almost nominal. Expressed in cents per day per inhabitant, the total cost of a filtered water supply is so small that notwithstanding the various demands upon the treasury for modern municipal service, the people of this country will insist upon having satisfactory service, rendered without extravagance, and will be satisfied only with such service.

Included in the operation of the purification plant may be mentioned, the writer believes, the element of education of the water consumers as to the main facts in the premises. There are too many public water supplies at present judged by citizens in an unfavorable light owing to misunderstanding, prejudice and indifference. A few words from the spring water seller as he stops at the various houses may do much towards forming opinions as to water supplies, and there are various elements of public opinion which are influenced to a surprising degree by the offhand comments of those who know little about the facts. The writer will speak briefly of his views as to the requirements of proper technical operation of water purification plants, but before doing so will touch briefly upon the question of sewage purification plants.

Just as water purification in America is of more recent origin than in Europe, so is the experience with sewage purification in this country more limited and more recent than

American experience with water purification. There exists today an anomaly about sewage purification which is difficult to reconcile. In Europe there are scores of sewage purification plants located on the outskirts of populous areas and which are operated without nuisance or complaint. In this country there are a few such, but as sewage purification represents an outgo rather than a source of income to a municipality, it is unfortunately true that too many sewage plants have been neglected. In consequence the ordinary municipal officer is likely to be quite confused in arriving at a correct solution as to the feasibility of purifying sewage in artificial works.

Those who travel much abroad and who have a casual knowledge of sewage purification in Europe frequently write and talk in extreme fashion as to the proper handling of sewage problems in this country. Some of them take violent offense at disposing of crude sewage by dilution in streams, regardless of whether or not there is sufficient oxygen in the flowing water to destroy the organic matter in the sewage. These theorists intimate that sewage purification is a comparatively easy and simple matter and that its operation can be readily provided for.

On the other hand, when one attempts to locate a sewage disposal plant in a suburban area there are a good many instances where land owners, even at a considerable distance from the proposed site, make strenuous objections. It is easy for them to find sewage disposal plants which have been seriously neglected and where complaints as to nuisances actually exist. It seems to make little or no difference with such people when informed as to improvements in design of plant or the means of overcoming the difficulties which result from poor operation. Stress is always laid upon the possibility of nuisance resulting from neglect and the inability of anyone to control absolutely the future as regards freedom from neglect.

With these widely varying views on the part of American citizens, it seems to the writer that those having to do with this branch of municipal service must not close their eyes to

the situation as it now exists. They must strenuously endeavor, where sewage disposal works are required, to see to it that they are operated in a way which experience in dozens of plases has demonstrated to be feasible. With the transmission of disease by means of flies, the importance of sewerage and sewage disposal is far greater than was recognized a few years ago, and a great majority of people will probably be surprised to know to what measure poor operation in the past explains the failure and delay in the proper advancement of this branch of municipal service. To the writer the case is a clear one, and for its correction proper operation must be provided, not only on the part of the municipality, but also of the State, partly through supervision of actual operations and partly through ready methods of punishment for neglect.

Procedures for the proper management of purification plants are bound to differ some, but there are certain requisites, in the opinion of the writer, that are worthy of mention at this time. The include an intelligent and frequent supervision on the part of persons in authority (State or otherwise) who are familiar with the general requirements of the plant and its ability to meet them; a superintendent or local manager who is familiar with the ordinary range of conditions and who has ability to adjust the schedule of operations to meet these varied conditions; a moderate technical equipment or laboratory, together with meters, gauges and other facilities for recording the required quantities; and finally, a staff of attendants who will faithfully carry out instructions. Obviously this set of arrangements is bound to vary considerably whether dealing with a plain sand filtration plant, a mechanical filter plant on a muddy stream, a softening plant or a sewage filter. These various details will not be entered into, but they are simply a statement of certain essentials as a general proposition.

Beginning with the attendants, there are two marked faults with filter attendants according to the writer's observation. One class is found in municipal plants, who secure their posi-

tions through political preferment. Their interest is superficial, combined with a desire to have their efforts call for a minimum outlay of work. The other class includes those who are bound to have their own way at all times and who cannot be relied upon to carry out instructions, particularly in plants where the treatment may have to be varied to meet rapidly fluctuating conditions. There are, of course, many men who come to such plants as political appointees and who fully accomplish all that can be reasonably expected of them. These comments are simply intended to make it plain that American purification works frequently suffer from employees assuming that serious efforts are not called for on their part because of some ''pull.'' Faithful and conscientious attendants is one of the most important requisites to securing satisfactory results.

As to laboratory equipment, $1,000 to $1,500 will ordinarily purchase the purely technical apparatus required for a moderate sized laboratory, although, of course, furniture, fixtures, plumbing, etc., particularly for the larger plants, increase this figure considerably. Included with this purely technical apparatus, in the writer's thought as to technical control, should be a full set of appliances as to rate controllers, loss of head gauges, depth recorders and devices for securing a uniform and proper control of solutions of chemicals where required, as well as facilities for measuring turbidity and color in the instances of sand filter plants which require the aid of coagulants at intervals.

It is the writer's belief that the day is rapidly approaching when in all the more important States daily records showing adequately the operation of purification plants will be required of water departments and sewer departments, not only by the city authorities, but by the State Boards of Health. Such results will indirectly accomplish much good in showing the departments many little things which will be to their benefit and will allow the hygienic aspects of the case to be kept under surveillance in a manner which is bound to accomplish good from time to time in the interests of the citizens.

About the superintendent of the purification plant there has been, and still is, more or less difference of opinion. Some think that he ought to be a mechanic, able to look after all mechanical appliances, and others think that he ought to have more or less technical training and ability to interpret, if not to make, the simpler analytical tests. It is certain that he should be able to get along well with the laborers employed around the plant; that he should have good business methods and that he should be willing to devote himself to the best interests of the plant. In the larger cities it is probable that there will always be both an analytical head and a mechanical head at the plant, each taking responsibility for certain proportions of the operating schedule under the general manager of the property. In cases where chemicals are required, either for coagulation or for softening, it seems clear that the responsibility should rest with men of technical training. Probably the best superintendent of the purification plant is the man with some analytical training and who has the gumption to grow into the control of the other portions of the plant. Of course there are many instances where the young technical graduate fails to do this on account of his inability to get along with other men, his dislike to take hold of dirty work himself, and his ideas as to working hours. On the other hand, as above stated, the best superintendents are probably men who start in with a technical training and who by their own efforts work to the top.

In the management of the smaller plants where the mechanical appliances, laboratory work and the control of the laborers all have to be vested in one man, a problem of considerable difficulty is presented. The man without a technical training is apt to get considerably off the track in analytical tests, and the writer is not in sympathy with that plan except where an experienced analyst and operator of purification plants supervises affairs from time to time. This field is probably one of the best for young technical graduates, and it is believed that the opportunities open in the larger cities for

experienced men will develop a set of young technical operators in small plants who will be willing to serve an apprenticeship of a number of years there to the mutual advantage of themselves and those who control small filter plants.

What has been said above with reference to water purification plants holds true in a large measure with regard to sewage purification plants. The latter attendants perhaps are more apt to neglect their duties than in the case of water filtration plants for the probable reason that the effluent is not examined by a large number of people as in the case of the water plant. The local authorities are also less apt to give the matter attention so long as they feel that no complaints or suits will arise from people living in the neighborhood. As the years go by the writer feels that the operators of sewage purification plants will have substantially a position of the same importance as those working with water purification plants, and he similarly believes that this is an excellent opening for the young technical graduate.

In all purification plants there is a certain amount of work, including some of the analytical tests, which can be done in a rule-of-thumb fashion according to directions which can be stated quite clearly and briefly. On the top of all such work there are certain conditions which will vary and to which varying conditions the operation of the plant must be adjusted. This is where the operator with the old-time ideas as to unvarying rule-of-thumb methods makes his failure. To show how adjustments under different conditions are to be made is one of the purposes of the laboratory, and another is to record for the men in charge of the department the actual results accomplished.

In analytical work for the control of purification plants there has been a marked change in ideas within the last ten years. It is no longer a case of determining free and albuminoid ammonia, nitrates, etc., but a question of taking those constituents which bear directly upon the management and the success of the plant in question and determining them at

quite frequent intervals. Thus in the case of a water purification plant the color, turbidity, taste, odor, alkalinity and bacteria are about all that is ordinarily required. If a coagulant is needed, its analysis and tests to show its strength should be made at fairly frequent intervals. In water softening plants, carbonic acid and incrustants also require attention. There are some plants with which the writer is familiar that do a vast amount of laboratory work of which probably three-fourths has no direct bearing. His position is that of sticking closely to the salient features and testing them out frequently so that the full benefit may be acquired in securing efficient results at minimum cost.

As to sewage purification, the first essential is to secure an effluent which will not putrefy. Suspended solids in the liquid as it passes through successive stages in the purification process throw much light on the behavior of the plant, as well as do tests for nitrates. Organic matter can be quickly approximated as oxygen consumed, and this apparently as a routine test is just as good as albuminoid ammonia or organic nitrogen.

The remaining test which is of importance with all purification processes is that of bacterial removal. This should be determined according to the standard procedures in current practice several times a day, preferably on several days each week, at different stages of the purification process. Besides the determination of bacterial numbers, various other special tests are required from time to time, particularly if bacterial growths develop to obscure the degree of removal as shown by the total bacterial counts.

DISCUSSION.

THE SECRETARY: There was one question, which, while an important one, was perhaps one of the minor ones in the paper of the last speaker. In fact, there are so many important questions to consider that each one

might be a subject for discussion. But the particular one that has been given considerab'e thought and some expression of thought recently has been that of the relative importance and relative amounts desirable of water and sewage purification. That is, some maintain that the sewage should be so purified before it is turned into the stream that you can go a few feet below the outlet and drink the water with impunity. Others maintain that the stream is bound to be rendered impure anyway before it reaches the next water intake, and consequently it is not necessary to purify the sewage because they have to purify the river water anyhow. Those two ideas have had very strenuous advocates in the past, but I think quite a number, if not the majority of the best informed are occupying something of a middle ground, that both these things should take place; there should be purification of sewage, and also purification of water.

Beginning at the water end, those who have said that the river would have to be purified anyhow, are undoubtedly correct in their statements. Take a river, especially a navigable stream over which boats pass carrying passengers, each boat probably provided with water closets and other sanitary arrangements, and from which the scraps of food and occasionally dirty linen, etc., are thrown overboard, and fed by smaller streams in which cattle wade and boys and men bathe, and in open streams of that kind which receive surreptitious discharges of fecal matter and the slops from small country and wayside hotels, etc., it is impossible to keep a stream of that kind from receiving more or less pollution. At any time some of this may be typhoid dejecta or other sources of infection of intestinal diseases. It seems, therefore, if we wish anything like safety from infection of this kind through the medium of drinking water, it is necessary to purify the waters of all streams the banks of which are at all thickly populated.

Water purification is beginning to be taken for granted, we may say. The Delaware river and the Passaic river and a few other rivers in the East are being made the subject of State supervision, and a great deal of work has been done and preparations are being made and carried out for a great deal more work in the protection of those streams from pollution and also in the purifying of water supplies taken from them. This being the case, and it being necessary according to the ideas of sanitarians to treat and purify the water in some way at any rate, it may seem that it would be an unnecessary expense to put a town to, to purify sewage before discharging it into the stream. Another argument of the advocates of water purification only is that if you discharge unpurified sewage into the stream, nature itself will effect, say roughly, seventy-five per cent. of the desired purification, simply by sedimentation, dilution and oxidation, the action of the water, the operation of the vegetable and animal organisms pretty well down in the sca'e—all of those things which are generally classed under the purification by dilution, that effects a considerable removal of the dangerous constituents of the sewage. If it does nothing else, it effects a considerable dilution of the sewage so that

the percentage of this entering into the water supply from the stream becomes very slight.

The expense of sewage purification is considerable, and it might be asked, therefore, Why not put all the expense on the water purification plant below and avoid altogether the expense of the sewage purification? Possibly one answer to that is more or less from a moral point of view, that the town which discharges the sewage into the stream should not be relieved of all the expense attendant upon its polluting the stream, and should not throw all the expense of purification on the town below which wishes to use the water of the stream. That would be rather assuming that the town above has a perfect right to throw sewage into the stream and if any town below wants to use the water they must attend to the purification afterwards.

Another view is that the discharge of sewage into a stream is not an inherent right according to the laws of the land; that a town does not have the right to so pollute the stream that any city below on that stream must be put to some expense for utilizing the water of that stream. We must remember that the discharging of large quantities of sewage into comparatively small streams not only pollutes the stream and makes it unsafe for drinking purposes, but that it is also liable to create an actual nuisance to the city itself, possibly, but more probably to those dwelling lower down along the banks, from the deposit of organic matter along the shores of the streams, behind dams, if such are located on it. Possibly, also, the organic matter which has settled to the bottom of the stream may putrefy, and the gases given off in hot weather may become very offensive. Possibly the most notable case we have of that is the Passaic river. The Thames in London was another striking example. Of course you have all heard the story of how the Thames became a national disgrace in that regard, and the gases along the river made it impossible for Parliament to continue in session, the Parliament building being on the banks of the stream, and Parliament had to adjourn. That was possibly the beginning of the national movement in England to control the pollution of English streams. So that it is necessary, in some cases at least, that the sewage be treated to avoid this actual nuisance in the streams.

Taking it altogether, it is my impression that sanitarians generally are coming to the view that both of these things should be done; that the sewage should be so purified that no nuisance can occur in the stream below; but, on the other hand, that it is not just or necessary to insist that every city or town discharging sewage into a large stream must completely purify that sewage or discharge as effluent something approaching drinking water in quality. I should be glad if other members would express their views because this is a very important matter, especially to those representatives of cities where the State boards of health are actually engaged in compelling purification of sewage. They are particularly interested in this question as to how far a State board has possibly any right, or how far they may go in compelling every town to purify its sewage;

whether every town *should* be so compelled, and to what extent they should be compelled to effect the purification.

Mr. Owen: There is one point I want to ask Mr. Fuller about, and that is the question whether the standard of the water is sometimes not carried too high? Of course we all know that in a pure stream the water is not capable of storage, whether in pipes or in reservoirs. The point to be arrived at is, first, that the standard of purity should not be the chemical standard, but the standard of ordinary waters used from rivers near there. It came to my knowledge particularly when I was investigating a certain supply and found that it had a very bad taste. In examining it further I found that the taste was not at the filter end, but at the end where the water was being consumed. The analysis also showed that chemically the water was perfectly pure, so the point arose in my mind whether it might not be too high an ideal of purification in that water, and whether we were not getting trouble from the growth of algae in the water. I would like to get Mr. Fuller's idea on that.

Mr. Fuller: I think there is no doubt that there are a good many instances such as Mr. Owen speaks about where the filtered water in an open reservoir will deteriorate, due to the growth of organisms. The removal of impure matter from the water of a flowing stream admits of the penetration of sunlight to a much greater depth in the reservoir. The sunlight and the constituents from the flowing stream itself make an excellent combination for the growth of algae. The real answer, I think, is to consider filtered water in covered reservoirs only. There are unfortunately a great many waterworks systems, some among the largest in the country, where the adoption of a filtered water scheme does not fit in very well on account of the open reservoirs. I believe a good many of those reservoirs, a generation hence, you will find to have been abandoned to a large degree, and those portions which are used will doubtless be covered, and by excluding the sunlight it is probable that the trouble of which Mr. Owen speaks will be eliminated. His trouble is really due to the penetration of the sunlight, which brings about the algae growth, and thus algae get into the dead ends and become lodged there and become decomposed, and give a bad odor at the faucet. It produces certainly a very peculiar combination of affairs. In instances I know of you get a bad tasting water in the stream. It is a very satisfactory water as to its chemical and bacteriological condition, but after it leaves the filter plant it goes to an open reservoir, develops algae and becomes objectionable, and the water goes on to the piping system and dead ends and becomes very offensive. I do not believe we should make a difference in the standards which we have in mind. The real point of water purification seems to me to make the water, first, safe so far as the removal of disease germs are concerned, and then make it satisfactory in appearance as it leaves the filtration plant, and then keep it from being exposed to sunlight and give it to the people in as good condition as when it leaves the filter.

Mr. Tribus: I think that question and answer might lead to a new class of investigation along medical lines, to find some bacteria with which to inoculate the water in that reservoir so that this desirable type (to be discovered) of bacteria could eat up the algae, so that the filtered water could be stored in the open.

Mr. Barrow: In our city we have had considerable to do with sewage purification. I am of the opinion that in any case a certain amount of sewage purification would be required. The degree of purification, I should think, might depend a good deal on the natural surroundings. For instance, if the discharge was into a large body of water, a lake or a river, I should imagine it would only be necessary to screen it or take out the larger substances, but if this was not done I think there would be a lot of fatty matter or substance that would be apt to decompose on the banks.

Mr. Eggers: I have always taken great interest in water supply, and I think I represent a city, which, perhaps, has the purest water supply there is in this country; at least only a few weeks ago the board of health declared it to be the purest water in the world. Our reservoirs are all open—some of you gentlemen have seen them—and our aim has been to keep our water supply pure. We have a plant which has already cost the city about $2,000,000. At the time that was built, it was built, of course, for two purposes. One purpose was to keep the city supplied with water for about twenty-five to twenty-eight days in case of a break in the principal mains which come from the watershed. After that reservoir was finished, all the water in the city was drawn from that reservoir, which is what is called a settling basin. It settles there. The city has been receiving a beautiful water supply since. It was money well spent. Probably other cities would have no use for it because they may be differently located.

Our water supply comes from the mountains, and we have spent a great deal of money up in the mountains there to depopulate the whole watershed. The legislature a year ago gave us the right to spend a million dollars more in buying the property up there. The city owns now about 10,000 acres. On the farms which we buy, we burn the houses, so that cattle, men, women and children are removed from our watershed. We intend to keep on doing this whenever we see a chance; wherever there is a place that might hurt our water, we buy up the property. Another thing we are doing up in the mountains is, we have commenced to plant trees. We started in the first year with 50,000, and now we will average every spring 100,000 little trees which we buy and plant on the watershed to raise forests there, which, no doubt, is no detriment to the water supply.

We have a high pressure in our city by mains which we laid some years ago in the principal business streets, and this year we are extending this supply into the factory districts. Of course those things cost money, but our water department so far is paying for itself. It pays the interest on every dollar of the indebtedness and pays for carrying on the work. Of course if we keep on spending as much money as we have I am afraid

the water department will not be self-sustaining much longer. We are fortunate in our city in that nobody lays anything in our way. As long as the people see we are trying to do our very best to give the city a pure water supply, there is no objection to our spending the money.

MR. HOWARD: I would like to call attention to the fact that in purifying water supplies the consumer does not get the same water that the bacteriologist examines at the filter plant. As an instance of that, the speaker has for ten or twelve years been supplied with a water filtered by the municipal plant. At the same time we have a so-called Pasteur filter on the pump from which the drinking water is drawn, and that filter will very soon become covered with deposit, as it used to before the water was filtered, showing that during the process of pumping and slight storage in the reservoir and then while going to the consumer, a certain amount of foreign matter is introduced into the water, either dust settling into the uncovered reservoir or by the various pipes, and the consumer does not get a water which is quite as pure as the bacteriological analysis will show, and it seems to me that should be considered. As Mr. Fuller says, the covering of the reservoir would be a great help in excluding city dust. It certainly should be considered, and it would not do any harm if the water was analyzed at the taps occasionally instead of altogether at the filtration plant.

MR. LUDLOW: In regard to what the last speaker has said, I realize and have often thought that the measure of purity or impurity in the water at the plant is not a fair criterion of what the consumer actually gets. I have found, however, in conducting a test at quite a large water works plant during the past four months, with that thought in mind I have, in addition to conducting a series of analyses of water at the filtration plant, as was required under the franchise contract, made a set of parallel analyses of tap water from various parts of the city. These analyses were made daily; they covered a complete range of sanitary analyses as well as chemical and bacteriological, and I have found within those four months of conducting analyses day by day, that in samples of water drawn from the taps in various portions of the system of a city of 70,000, the bacteriological count has been almost identical whether from the samples drawn from the tap or from the main just outside the pump; the bacteriological count has run nearly parallel, although it may possibly have varied fifteen to twenty per cc. The hardness is, of course, unchanged, and the tastes and odors, or the causes of those odors and tastes, have been eliminated and shown to be eliminated throughout the pipe distribution system. So the result of that test has been an assurance that by properly filtering water the organic matter is so sufficiently removed as to remove the bacterial food or the substance or processes that will maintain bacteria life, that the water delivered in the pipes may be measured by the same standards and reach as high a standard of purity as at the station itself.

In the same connection the thought has occurred to me, in connection with Mr. Owen's question and Mr. Fuller's answer, that one cause of tastes and odors may have been overlooked, which is possibly the cause in the case Mr. Owen cites, and that is, the growth of rust in the water pipes, the presence of iron in the water. If there is a growth of that sort, it will manifest itself at the extreme ends of the distribution system most distant from the reservoir, just as I understood Mr. Owen to say. The covering of the reservoirs will not remove that, but that must be remedied by more complete treatment to remove the iron. In doing so that one potent cause of offensive odors and tastes will be removed.

The President: One thought is suggested to me by what Judge Eggers said in regard to the fact that they were planting trees on the watershed. That is, that I think it is generally understood at the present time that the existence of forests on a watershed does not increase the rainfall, and that the forests simply retard the flow of the water to the receiving basins, or rivers, or whatever may catch it. That being the case, is there any necessity from a water supply standpoint, of planting trees on a watershed? Isn't that wasting the money of the water supply?

Mr. Eggers: I will answer that we expect in fifteen to twenty-five years from now that our city will have quite an income from the timber on the watershed. You know the nature of our watershed—you have been up there. It is a rocky country there, but still there is a good growth of trees. Now the expense which we have gone to so far has almost been made up now out of trees which were cut down and the wood sold, and I think a forest is a good thing to grow anywhere, if you can do it.

Our country is depleted of forests, and it may be a little bit of a notion of my own, as I came from a forester's family and have grown up in a forest and have much love for a forest, but our people in the City of Newark see us do it gladly. There has never been a single criticism for our doing so. It does not cost such a great deal. We spend probably every year from five to eight hundred dollars. We have our men up there who do the work; there is no extra cost for the work. I hope in fifteen or twenty years longer that that watershed will be covered with trees.

Mr. Fisher: I am interested in what has been said by Mr. Eggers as to the watershed, and I want to say that in Rochester that has been our plan for taking care of the water supply from the time the works were first built. We are buying up as fast as possible land along the watershed from which contamination might be expected. We have all the shores of Hemlock Lake now, with the exception of a small village at the head of the lake, which is seven miles from the inlet and is well taken care of. We are about to take another small lake, having received authority from the council recently to purchase the shores surrounding that lake. We have just completed an open reservoir, and all of the other reservoirs connected with the system are open. So far as I have ever known, we

have no record that any trouble comes from our water supply. We think we have a supply as good as that reported by Judge Eggers for his city.

Mr. Pollock: I should think the main object of planting trees on the watershed would be to delay the flow of water to the streams, and in that way make the supply more regular throughout the year, rather than any advantage in any other way.

The Secretary: I was about to make the same remark that Mr. Pollock made. In comment on that remark, it is well recognized that trees do not increase the rainfall, but accomplish the object stated by Mr. Pollock, and also tend to hold the water like a sponge in the ground and prevent its running too rapidly into the reservoir. If it were possible to retard the flow to half the rapidity it would ordinarily have, we can to that extent diminish the size of the storage reservoir necessary to hold our surplus water, and it may be the actual expense of planting the trees would be more than covered by the diminution in size of the storage reservoir. If the reservoir is not decreased in size, we certainly would increase by that amount the storage we obtain, because we utilize not only the reservoir itself, but the entire watershed in storing up the water which, if the trees were not there, would run into the reservoir, and if the reservoir were not large enough would escape in the overflow. Almost all the large reservoirs in the country, I believe, expect to lose more or less water in time of flood by the overflow. The provision for overflows is not merely a provision that *may* be called upon, but is one that *is* called upon almost every year. The New England engineers assume that only about thirty per cent. of the rainfall in a watershel can be utilized by any practical size of storage reservoir, whereas the runoff is approximately fifty per cent., showing that apparently about twenty per cent. is lost, not by evaporation, but in other ways, by overflowing the reservoir in many cases. The certainty is, as we know by cases in the west, that if it were not for the vegetation on the watershed, as in the case of a rocky watershed or one entirely denuded of vegetation, they would lose a very high percentage of the water unless they increased the size of storage reservoirs very largely. Another secondary effect of trees, resulting from this first effect just mentioned, is that the rapid flowing off of the water which would be permitted by the denuding of the watershed would wash the soil down into the reservoir and thus fill up the reservoir. Probably you can all recollect cases in which reservoirs have been extensively filled up by clay washed off of denuded hillsides. In the western country, where there is very little vegetation, in the semi-arid lands, for instance, in southern California and in Texas, the reservoirs fill up very rapidly. The Austin dam, which was unfortunately washed out a few years ago, and which was in position only a few years, was found to have been silted up almost half the height of the dam in the few years since its construction. It seems to me that these considerations make it well worth while to plant and retain trees on the watershed.

Mr. Ludlow: In the line of Mr. Folwell's suggestion as to denuded forest, I would say further to justify the planting of forests, that the process by which the erosion of the soil takes place and the filling up of the reservoir, while that is serious and will cause great expense and time to remove, during that interval there is a constant expense going forward by the increased turbidity, which increased turbidity requires an additional expenditure for coagulant to purify the water. It appears to me a safe proposition that comparing a watershed that is fairly well forested with one which is pretty well denuded of forest, the difference in cost of coagulant alone would probably amount to quite as much as the annual cost of gradually bringing that watershed into condition of forest growth. It has been to my mind one of the primary lessons of pub'ic water supply that the tree or forest growth, the complete covering of tree mantle, has been an ideal condition of the source of water supply. The first desirable condition of public water supp!y is that the watershed should be free of population, as a matter of course; the next may be that it shall have a porous soil, a sandy surface soil, soil that will retain water and not let it flow off too rapidly. These are ideal conditions. The next, it appears to me, is to have it forested. When we have that, we certainly have all the conditions of mountain water supply; and it is recognized by us all, I believe, that there is no safer or more favorable source to go to for water supply than to the mountain summits, where rainfall is reasonably great, where there is tree growth and a forest floor to hold the water back and an impossibility of supporting population. That gives us as near as we can approach to the ideal conditions of water supply.

Mr. Baker: If I may be permitted to say a word in connection with this discussion, I would like to call attention to the fact that the subject of the relation of forests to runoff has been very exhaustively discussed recently by Lieut.-Col. H. M. Chittenden, in a paper which may be found in the September Proceedings of the American Society of Civil Engineers, and in that paper Colonel Chittenden goes quite contrary to practically every idea that has been expressed thus far on the floor here this morning. While I think he has gone too far in the matter, yet his arguments are certainly well worth the consideration of every one who is interested in this subject of the relation of forests to runoff. He is discussing the subject in his paper primarily from the viewpoint of the relation of forests to floods, but he takes up, for instance, this very matter of erosion which has its relation to turbidity, which has been mentioned, and he maintains vigorously, with many supporting arguments, that the erosion is no greater from a deforested area than from one that is in forest. I will not attempt to repeat his arguments, because those interested should go to the original source of information as bearing on that. He feels very strongly that the advocates of forestry have been repeating through decades arguments as to the benefits or forests utterly false and fallacious so far as any relation whatever which they may have to runoff.

He will not even give very much credit to forests as an equalizer of flow. Now I think, whatever the forestry people may hold on the subject, that engineers pretty generally have long ago abandoned, if they ever held, the idea that forests had any beneficial effect so far as rainfall was concerned. The engineers pretty generally, I think, still hold to the view that they do have a beneficial effect in reducing floods. Now he doesn't agree to that at all. It is to be noted, however, that he is considering the subject from the standpoint of the large streams of the country rather than the small streams of the country, and is not taking up the thing at all from the standpoint of municipal supplies. And he does recognize the fact that there is a certain equalization of flow in springs and in small streams. His discussion is well worth the consideration of every one who is interested in this subject. He deems the time has come when engineers should cut loose from the common ideas passed from mouth to mouth, and on which the forestry people are basing their strongest arguments for beginning a forest policy for this country.

In doing that he is not arguing against forestry as such, which he says can stand on its own bottom, as I think any one will agree who has any idea whatever as to the extent at which the forests of the country are disappearing and the growing scarcity and increasing price of timber. Now it seems to me that every one who is responsible for a municipal water supply of surface origin, is going into forestry from the standpoint of its relations to the timber supply of the country and its possible yield of future income. But any one who owns land and considers the forestry problem as a personal one, and thinks that in view of this depletion of our timber supply he has some responsibilities in the way of planting trees, becomes pretty well discouraged when he sits down and figures the cost, especially unless he is very young; because he can see that he can never get a dollar, or many dollars, out of forest planting. If he has an area of land already forested, he may get a revenue. It, therefore, comes to this, that it will be the large corporations, like the railways for instance, that must have ties and other timber supplies, and like the paper and pulp companies, and then, on the other hand, the State governments, and as far as possible, the national government and the municipalities in so far as they own land areas, upon which we must rely for the forestry work; and the municipalities owning these large drainage areas that are now running up into thousands of acres, can well afford to do it, because they are working for future generations, and can afford to adopt a policy of forest planting.

SEWAGE PURIFICATION VS. WATER PURIFICATION.

By George C. Whipple, New York City.

Water filtration and sewage purification are not antagonistic, as might be inferred from the title, any more than the hammer and the mallet of the carpenter's chest are antagonistic. Both of these tools are needed and they are handled by the craftsman in a somewhat similar way, yet each has a particular use. The skilled workman always knows which tool to use; the apprentice and the amateur sometimes use the wrong tool. So it is with the two sanitary measures referred to. Water filtration is an agency for rendering a natural water or a polluted water clean and wholesome; the various methods of sewage purification are primarily agencies for helping to dispose of the fecal and industrial wastes of a community without nuisance. Both are alike in that they seek to remove objectionable or polluting substances from water; but in one case the pollution of the water to be treated is relatively small and can be easily and cheaply removed, while in the other case the polluting matters of sewage are large in amount and can be removed only at considerable expense. So obviously simply is this proposition that it seems strange that municipalities should ever attempt to use the wrong tool. Yet in the protection of public water supplies the attention of the public is sometimes distracted from water filtration by plausible arguments, in favor of sewage purification. The attempt is made to use the mallet, when the hammer would be more effective.

Take, for example, the case of a certain city situated on one of our large lakes. Like many other cities similarly situated, it discharged its raw sewage into the lake with little expense and with no nuisance to sight or smell; it also took its water supply from the same lake, and the natural consequence was a high death rate from typhoid fever. In the course of time the city awakened to the danger, and the question of filtering

the water was agitated. All the official sanitary advisers and most of the citizens favored this; but others said, "No, let us purify the sewage and the wholesomeness of the water will follow as a matter of course." This idea may have had its animus partly in political circles, but it was a plausible suggestion and was accepted by many. Water filtration ultimately triumphed, but its introduction was retarded by a discussion based on false premises.

Again, take the case of a large river with many communities along its shores, some using the waters of the stream for drinking purposes, and all, perhaps, using it as a place of depositing sewage. Suppose that all these communities had sewage purification plants of the ordinary type which discharged the effluents into the river, would the water supplies of the down-stream communities be safe? By no means. Ordinary sewage purification plants do not turn out drinking water, while the mere presence of a large community upon the shores of a stream, with all the necessarily involved opportunities for occasional or accidental contamination, is in itself a menace to a water supply taken from the stream below it.

To adequately safeguard the purity of public water supplies taken from rivers and lakes in populous regions there is only one course to pursue, and that is to filter the water. If the water is but slightly polluted, filtration is sufficient; if the pollution is considerable, chemical treatment or double filtration should be used or the pollution should be reduced by means of proper sewage disposal plants. There are some cases now, and as the country grows, these will become more numerous, where both sewage purification works and filter plants are necessary, but under most conditions water filtration logically should be put first, for it costs less and is more efficient. Of course, this statement, like all general statements, is not without exception, and some cases undoubtedly exist, as the speaker well knows, where to thoroughly purify a very small amount of sewage that is endangering a large water supply is cheaper than to filter the entire supply.

Some may think that there is no occasion for calling attention to this question of the relative importance of water filtration and sewage purification, but a study of the articles that are appearing in the popular magazines and papers of the day, indicate that so far as the protection of water supplies is concerned there is a tendency to place the emphasis in the wrong place. In some States, as in New York, the State Department of Health has authority to compel a city or town to install sewage purification works, but has no authority to compel the filtration of water. Plans for sewer systems have to be examined and approved by the Health Department, but plans for waterworks systems do not have to be so approved. This condition is scientifically illogical and deserves correction.

The speaker has never forgotten the remark made to him a few years ago by a distinguished German sanitarian who was visiting this country for the purpose of studying the admirable sanitary work of the Massachusetts State Board of Health. He said, "It is all very fine, but very funny. You purify your sewage, but you drink your water raw." It was contrary to sanitary science, as he knew it.

What has brought about this condition? It is partly due to the natural feeling that is expressed in the saying that "innocence is better than repentance," and that "pure water is better than purified water." Taken literally, no one can question the soundness of this principle. The difficulty is where to find the water supply that is naturally pure, or that is not liable to pollution.

It is due partly to a natural feeling of repugnance at the idea of allowing the waters of streams to be contaminated and then spending money to purify them. To this it may be said that it is only a question of time and place when and where the contamination is removed; in one case the fecal matter is largely, but not wholly removed from the sewer water before it reaches the river, while in the other case it is removed from the river water more effectively at a point nearer the consumer. The essential thing is that some purifying mechanism stand

between the source of pollution and the water tap and it is not a question of where this is, but of how efficient it is.

Sewage disposal is attracting public attention for another reason. There have been recently some remarkable improvements in methods of sewage purification. These took their origin in England, from whence they have spread to other countries and to America. Unquestionably, these methods are interesting and deserve attention, but it ought not to be forgotten that they took their rise in a country where the water supplies are almost universally filtered. Water filtration in England was an old story a generation ago. England, because of her dense population, has advanced to the second stage where she demands both sewage purification and water filtration. America ought not to take the second step before the first. She will not do so if she follows the advice of her trained sanitarians instead of the amateurs who seize upon the striking topics of the hour and do not consider the subject in a broad, conservative way.

As an illustration of the effect of popular sanitary writings, an instance may be mentioned that once came to the speaker's notice.

A wealthy man, owning a large estate, went to an expert for advice as to the question of sewage disposal. He had been reading the "House Beautiful," or something like that, and had learned that sewage must be treated by two processes, one the *aerobic*, and the other the *anaerobic*. He could pronounce these words glibly and knew what they meant. He also knew that a septic tank and a contact bed would give the two processes an opportunity to work; and being a man of action, as well as thought, he had constructed such a plant near his house. The result was that the family had to move out for a time until the caretaker, a common-sense farmer, who did not understand the difference between a septic tank and a cesspool, succeeded in conveying the tank effluent into some tile drains hastily laid. This change resulted in an entire elimination of the nuisance as there was an unlimited acreage

available. Yet the enthusiastic reader of the "House Beautiful" still felt so much anxiety because the sewage was not being purified *aerobically* and *anaerobically* that he was willing to pay for expert advice in order to see how these desirable processes could be secured. He was told that his farmer was entitled to the fee as he had already solved the problem.

But deeper than all this is the popular demand for decency. The watchword of the day is *cleanliness.* Cleaner houses, cleaner streets, cleaner food, cleaner politics and cleaner lives are things that the world is striving for. Since the day when the bacteriologist proved that dirt is dangerous there has been a wonderful response to the sanitarian's call for cleanliness, and it has had wonderful results, as the vital statistics show. It is not surprising, therefore, that cleanliness for the sake of health should be followed by cleanliness for its own sake. With this demand for decency, the speaker is in hearty sympathy. But the science of sanitation is a new science, and it is easy for false theories to take root and for sound theories to become overworked. Amid the brilliant researches that are being made there is needed the saving grace of common sense.

This country is growing rapidly and the cities are growing faster than the rural districts. Manufacturing is increasing and the factories are naturally locating along the water courses. The waters of our rivers are therefore becoming foul to an increasing extent, doing great damage and in some cases, irretrievable injury. This is a serious matter; for if by increasing our capital in the form of factories and mills, we decrease it in the form of natural resources, then we are not as a nation, growing rich as rapidly as we think. Already some streams in America are as greatly polluted as many in England, as, for instance, the Passaic river, in New Jersey, about which so much is just now being said.

To restore these polluted streams to their pristine purity will be impracticable, if not impossible; but they can be prevented from becoming a nuisance to sight and smell and a menace to health by a rigorous policy of exclusion or purifica-

tion of sewage and trade wastes, and the speaker believes that this ought to be done before, rather than after, the streams have become overcharged with pollution.

During the past few weeks a notable event has occurred in England. The Royal Commission on Sewage Disposal, after several years' study of the whole matter, has submitted its report and formulated its findings, placing its official approval on some of the modern methods of purification and cautioning against some of their weaknesses. As a sane, common sense document, this report is worthy of great commendation and its influence ought to be widespread in the sanitary world. Much criticised in the past for not immediately accepting each new theory as soon as propounded, the scientific conservatism of this commission will give its report added weight in years to come.

One thing is conspicuous throughout this report of the Royal Commission, and that is that the whole question of sewage disposal is treated from the standpoint of nuisance. It is recognized that disposal works are to be operated to prevent offensive conditions, not to protect water supplies. The degree of purification is to be adjusted to the stream into which the effluent is discharged. Disposal by dilution is tacitly recognized as a sensible and legitimate form of treatment. Nature's methods of purification are to be availed of so far as they are capable of acting.

To quote from the report: "We are satisfied that rivers generally, those traversing agricultural as well as those draining manufacturing or urban areas, are necessarily exposed to other pollutions besides sewage, and it appears to us, therefore, that any authority taking water from such rivers for the purpose of water supply must be held to be aware of the risks to which the water is exposed, and that it should be regarded as part of the duty of that authority, systematically and thoroughly, to purify the water before distributing it to their customers.

"Apart from the question of drinking waters, we find no

evidence to show that the mere presence of organisms of a noxious character in a river constitutes a danger to public health or destroys the amenities of the river. Generally speaking, therefore, we do not consider that in the present state of knowledge, we should be justified in recommending that it should be the duty of a local authority to treat its sewage so that it should be bacteriologically pure."

The speaker believes that this is as it should be. Sewage purification plants should be built where they are needed to prevent nuisance; where the streams are small and the volume of sewage great their efficiency should be high; where the danger of nuisance is slight the efficiency of the plant need not be high; where the dilution is sufficient no other process than screening need be used. But septic tanks, sprinkling filters and contact beds should not be depended upon to protect water supplies, functions for which they are naturally not fitted. The influences that bring about the self-purification of streams may be utilized to mitigate the nuisances of sewage pollution, but are not to be depended upon to protect water supplies to be used for drinking.

In this discussion one point has not been mentioned, and that is the responsibility that one community owes to another. Is it right that an up-stream community, by polluting a river, should put a down-stream community to the expense of filter- its water supply? On the other hand, has the down-stream community a right to insist that the up-stream community shall change its sewage into drinking water? These are very important questions, involving various common law rights, which are jurists should lose no time in making clear. That which our jurists should lose no time in making clear. That many equities that will have to be adjusted and these will vary under different conditions, but if the principle is recognized that filtration plants are best adapted to protect water supply and that sewage purification plants are best adapted to prevent general nuisances, it will be found easier to adjust these equities; and if our State Departments of Health and our sanitary laws can be made to conform to this principle, there will be a great saving of expense and a more rapid improvement in the public health.

TIGHT JOINTS IN PIPE SEWERS.

By B. E. Briggs, City Engineer, Erie, Pa.

This is a simple tale of my personal experience and practice. The importance of tight joints in pipe sewers was impressed upon my mind early in life in a small western town for which I prepared plans and specifications for a sewer. It was my first experience in this sort of work and I prided myself that I had fixed the joints so that none of the sewerage would get away, by providing that the pipe layer should use his hands in applying the cement mortar until the joints were evenly filled on the bottom, sides and top of the pipe, and that the joints be swabbed from the inside to remove any mortar that might have passed through between the ends of the pipe. The town council decided to import from a neighboring city an experienced sewer man. He proved to be a big, husky son of Erin, who, after looking over my specifications proposed to tell me "more in a minute about sewers than the person who wrote those specifications would ever know." He said "the joints should be open on the bottom so that a portion and sometimes all the water would seep out, thereby causing less odor at the outlet," and added, "whoever heard of a man using his hands to place mortar when trowels were made for that purpose," together with many caustic remarks which caused my ears to burn for days.

Some 2,000 feet of sewers were laid under those specifications by the experienced sewer man from the city, but not under my supervision. So well did the contractor carry out his idea of open joints that when, several months later, I examined the work, I found, to my great mortification, a small creek of spring-like water flowing from the outlet, the sewers having drained a number of wells and cisterns along their course.

The ordinary contractor is averse to making tight joints, arguing that they are an unnecessary expense. I have found it exceedingly difficult, and in many cases impossible, to satisfactorily impress on the average person that has to do with the laying of sewers, the importance of making the joints tight; and I have personal knowledge of cases where due consideration was not given to this important feature in sewer work by those who prepare plans and specifications for sewer systems. I recently examined a few sewers with a view of determining as nearly as possible the exact amount of infiltration. To my surprise I found that in one extreme case fifty-two gallons per minute was flowing from 420 feet of nine-inch sewer, laid in 1896, for a real estate company. There is but one small residence connected with that sewer.

Sewer contractors have frequently assured me that it is not at all difficult to make tight joints in a dry trench; meaning probably that the joint they make, though imperfect according to my standard, would answer the purpose under such conditions. I have found, however, that when they were permitted to use water to settle the earth in the trench, a method which I avoid if possible, there was considerable leakage into the sewer whether the trench was dry or wet.

The Department of Engineering of the City of Erie, which I represent, has expended during the past fifteen years a great deal of money repairing breaks in sewers and streets, caused by defective joints. In an effort to stop that financial leak on future improvements, I procured copies of sewer specifications from neighboring cities and personally experimented with every scheme suggested for making tight joints. All kinds of trouble was experienced in trying to persuade or compel the pipelayer to follow instructions and give the various methods a fair trial. The main fault seemed to lie in his failure to properly place the gasket in the socket under the pipe. For after a pipe was finally set, it was often found that the gasket, on the under side, was either out of the socket or had been caught by the pipe which was being laid and jammed between

the ends of the two pipes. From the point of view of the inspection, at the top of the trench, the joint would appear to have been perfectly made. It soon became evident to me that success depended as much upon the man in the trench as upon the method. The man had to be taught, and this I did by giving demonstrations.

I decided to use a fairly large oakum gasket, prepared in advance in lengths sufficient to pass around the pipe and with the ends lapped over enough to equal the diameter of the pipe. The gasket should be immersed for several minutes before using in a bucket of Portland cement and water mixed in the proportions of about one to one. It should be so placed in the bucket that it can be readily removed and speedily placed in position by the pipelayer's assistant by taking one end in each hand, in which position he draws it around the end of the pipe as it is being laid, or he drops the center of it in the lower part of the socket of the pipe previously laid and the next pipe is laid on it. Then the ends of the gasket are drawn across the top of the pipe and it is driven into the annular space, working from the sides to the top, after which the joint is neatly trimmed with stiff mortar. Either manner of placing the gasket, as mentioned above, is satisfactory in a dry trench, but in a wet trench the best results are obtained by placing it around the end of the pipe as it is laid.

The greatest difficulty encountered was to procure a desirable oakum and in such form as to insure economy and dispatch in preparing the gaskets. The common practice of using plain or tarred baled oakum, from which the contractor twisted his gaskets, proved unsatisfactory because the gaskets were of uneven thickness and could not be forced into the joint, and the tarred spun oakum was discarded because it would not absorb the cement. An investigation among the dealers in hemp, from which oakum is produced, revealed a product spun into strands, of which two or more were twisted into a loose rope called "hemp packing." It can be cut into the desired lengths with a very small per cent of waste, and it absorbs a

large quantity of the thin cement mortar. One strand is about the proper thickness for an eight-inch pipe, and two strands for a twelve-inch pipe. By using the largest gasket that will permit the pipe to enter to the full depth of the socket, and having it well filled with cement, you will make a good, tight joint, although the pipelayer may neglect, as he often will, to fill the lower part of the socket with mortar.

As the joint is the weak point in all pipe sewers and the cause of most of the trouble, I considered it advisable to eliminate as many joints as possible, which was accomplished by adopting the three-foot lengths of pipe with deep, wide sockets, in place of the standard pipe in common use. A local pipe dealer informs me that the long pipe, of twelve-inch diameter, cost about three per cent more per foot than the standard pipe. We still permit the use of standard lengths of pipe to some extent, when they are cemented together in pairs for about four days before laying. The difficulty of safely laying a piece four feet long was carefully considered; and in order to have it evenly bedded in such a position that it will not break, the contractor is required to make a soft bed in a hard bottom trench and remove the earth from beneath each collar; and in backfilling, to have a man stand on the pipe to detect and prevent any moving of the pipe while he tamps the earth around it, alternating from side to side, with an iron tamper similar to that used in railroad track work.

An argument in favor of laying the longer sections of pipe, aside from the fact that there are a less number of joints to be made in the trench, is that owing to their increased weight they are less liable to crawl under the weight of a sliding backfill, which, no doubt, is the cause of many open joints in wet, heavy soils.

As the greatest difficulty in producing a tight joint occurs in a very wet trench where the best possible joint is most necessary, I have devoted more time in an effort to accomplish the desired result under such conditions, and have finally adopted and required the use, in very wet trenches, of the

"W. S. Gasket," which, I believe, is a patented article. These are made for various sizes of pipe and consist of a narrow bag of cheese-cloth, slightly longer than the outer circumference of the pipe, with a strand of oakum passing through one side. The bag is divided into pockets by means of pasted seams, and filled with cement. The paste is readily dissolved by the water, permitting the cement in the pockets to unite as the gasket is driven into the annular space. The use of this gasket runs the cost per joint up to about three times that of the common oakum and cement filled joint, but an amount equal to that difference is allowed the contractor on each joint. The city furnishes the gaskets to the contractors at cost.

Another method of making a good, tight joint in the water is by the use of a mixture of one part coal tar and three parts of Portland cement thoroughly mixed into a putty. After an oakum gasket is placed, this putty is forced in by hand. The operation is simple and effective against the water. The workmen, however, object very seriously to the tar on their hands. The material required for one joint for a twelve-inch pipe with deep and wide socket, depends largely on the size of the gasket, but ordinarily one pint of tar and three pints of cement completely fills the joint. The material best suited for this work is called hydrated tar, which is crude coal tar with the ammonia water removed.

In several instances, when repairing breaks in sewers carrying a large amount of water, where it was found impossible to stop leaks at the joints with oakum and cement, I have used plaster of Paris with oakum with fair success, afterwards finishing the joint with cement mortar. The plaster is made in a thin paste and worked into the gasket until it contains all it will carry. As the plaster sets very quickly the work of preparing and placing the gasket and setting the pipe must be performed with great rapidity.

The methods outlined above have thus far proved satisfactory. Of course, time alone will prove whether they are the best or not. It is, however, an indisputable fact that the suc-

cess of any method depends largely upon the intelligence and skill of the workmen. Also, that the average man working in the trench today is a very different specimen from the one of twenty years ago. The foreigner of today cannot be depended upon to understand or follow verbal instructions. I find, however, that he learns quickly by sight, and will follow a given line. It is to this fact that I attribute the success of my methods.

DISCUSSION.

MR. BARROW: In reference to the report just read, I would state that considerable leakage seems to take place in brick sewers, especially after they have been laid several years. In the city where I reside they were laid about fifty years ago with lime mortar, and they have worn away. They require attention as well as the others.

THE SECRETARY: I understand, Mr. Barrow, you think the leakage is due to a scouring until the sewer was worn so that the sewage leaked through. I think there was a case in Baltimore or Washington where the brick sewer wore through entirely so that possibly one-fourth of the invert was the natural dirt.

MR. BARROW: I have seen some instances in my city. The City of Omaha had some brick sewers worn entirely through. Some were replaced with vitrified brick so as to reduce the difficulty.

MR. MERIWETHER: Mr. James H. Fuertes, consulting engineer, has stated that he has laid concrete sewers on heavy grades with vitrified brick with 1 to 1 Portland cement mortar, and they have stood better than sewers with brick inverts.

THE CONSTRUCTION OF A REINFORCED CONCRETE INTERCEPTING SEWER.

By Alexander J. Taylor, Engineer in Charge of Sewers, Wilmington, Del.

The water supply of the City of Wilmington, Del., is obtained wholly from the Brandywine Creek, a decidedly erratic stream, draining a country approximating in area three hundred and fifty square miles. The intake and the stream above it, for a distance of a mile and a half, lies within the limits of the municipality. The preservation of its waters in as pure a state as possible, and the prevention of additional pollution to the stream have ever been a matter of grave consideration for the authorities. The safeguards, at present, consist of an intercepting sewer skirting the southern and more inhabited slope; this being extended from time to time further up stream to meet the requirements of a growing population and to care for the increased amount of refuse from the many enlarged mill properties bordering upon the creek. In addition a daily patrol has been established and kept in service.

Lately, the large demands from these properties, unexpected at the time of designing, and from the increased settlement of the contributing territory, have resulted in overtaxing the capacity of the sewer during periods of maximum flow, frequently causing it to run under pressure, lifting the manhole covers from their frames and overflowing into the creek with a resulting contamination of the city's drinking water.

It may be interesting to note, in passing, that the sewer upon being subjected to the maximum head of ten feet has cracked in numerous places at its weakest point, where it is built of twenty-inch standard terra cotta pipe. The cracks are variously located from the springing line to the crown and occur more frequently at the bell than at the spigot end. There seems to be no question from the available records but

that the materials and the workmanship employed were the best procurable; that the sewer was laid under able supervision by the Street and Sewer Department's own men with an efficient inspection by the Water Department of the city, which, of course, was vitally interested in securing good work. Temporary repairs have been made from time to time by encasing the broken parts in concrete, with the result of causing fresh breaks to appear in other sections.

This at last becoming intolerable, a permanent remedy was sought and found in the building of a relief sewer, whose outlet is located just within the head gates of a race taking water from the same dam as does that of the city supply, but situated on the opposite side of the creek. From here the relief sewer's course lies along the water's edge, running for quite a distance in a narrow strip of land between the creek and some settling ponds, then along the creek wall of a paper mill, crossing their tail race where sixty feet wide, then over the creek by an inverted siphon, then paralleling the present sewer for a distance of about 900 feet and joining it just below a large cotton mill. A portion of its length will be available for the intercepting sewer on the northern bank when conditions demand its construction. The total length of the new work comprises eighteen hundred feet of thirty-six inch and thirteen hundred feet of thirty-inch pipe.

As a guide in determining the quantity of sewage for which to provide, observations were taken on the velocity in the present sewer by means of floats, and the results obtained used in conjunction with the areas of the wetted sections to calculate the average volume passing. From similar observations, in addition to weir measurements, the quantity of liquid refuse to be taken from the various mills, whether present or future contributors, was estimated. Rain water was carefully excluded and in the upper district an auxiliary storm water sewer was built to further this project. From a consideration of these factors and with an extra percentage for future increments, the sizes as indicated above were determined.

It is confidently expected that not only will the capacity of the sewer below the junction of the old and the new lines be increased by the additional facilities provided, but also that the portion now in service above this point will carry a greater volume, due to the decreased friction secured by cutting off a long line of smaller pipe and thus put off for several years the further extension of the relief work. This additional capacity would be approximately a gain of thirty per cent.

In deciding upon the character and the material from which the structure should be built, terra cotta pipe, monolithic concrete and brick were each rejected in turn from considerations of economy and ease of construction, and a decision made in favor of reinforced concrete pipes with curves of brick where angles occur. The points adverse to the use of such a pipe were considered and disposed of as follows: The character of the sewage for quite a considerable portion of the course is acidulous, in consequence of which there were fears of a softening or solvent action upon the concrete composing the pipe. As an experiment a portion of a condemned pipe was immersed in representative sewage and allowed to remain for ten months without showing any alteration. A further safeguard to the lower portion of the sewer consists in its receiving the lime water from a paper mill in quantity probably sufficient to neutralize the acid, while the latter in turn may be expected to prevent any lime incrustations.

The reinforced concrete pipes were made by the regular sewer workmen in immediate proximity to where they were to be laid, the mixing boards being moved every morning before starting work. Probably every one is familiar with their construction, but an outline of the work may not be amiss. The concrete was mixed in the proportion of one part Portland cement, three parts sand and stone dust combined, and four parts three-quarter inch stone. This resulted in forming a mass possessing compactness as well as strength. The pipe being exposed on all sides after completion, ample opportunities were presented to judge of this. The sections are three feet in

MANUFACTURING CONCRETE PIPE.

length, varying in thickness from 3½ inches for the thirty-inch to 4 inches for the thirty-six-inch pipe, and are reinforced with two circumferential bands, ⅛ inch by 1½ inch, placed one foot apart and one foot from each end. These are slotted to allow five longitudinal bars to be threaded through them. These longitudinal bars extend beyond the shoulders of the pipe and are hooked at the ends to provide for interlocking the various sections, after the latter are placed in position, by means of an additional circumferential band slipped through the hooks. Steel forms with an outer and inner ring were used, each being in three separate pieces, which were joined together when set up on the cast-iron bed plate. The pipe was cast in a vertical position with the bell end down. The bottom ring is first placed in position, levelled and greased, the wall forms, previously oiled, are next slipped into position and latched, sliding on grooves in the bottom ring. The longitudinal reinforcing bars are then set in position, their lower hooked ends entering into depressions made in the lower rings to receive them. At the upper end these bars are caught and held in position by clamps, which serve in addition to keep the wall forms the proper distance apart. A stiffening band is slipped inside of and hung upon the upper end of the inner cylinder to prevent distortion of it. Each mold, when set up and braced, is an exact duplicate of the others, so the finished sections must fit when joined.

The concrete must be carefully tamped in layers not exceeding two or three inches in depth, or the unconsolidated portions will show and form weak spots in the completed work. When one foot of concrete has been deposited and rammed, the clamps on the longitudinal bars are removed temporarily, a circumferential band slipped over them down to the concrete, the clamps replaced and concreting resumed. After another foot in height is completed a second circumferential band is similarly placed. When the upper end of the pipe is reached, a cast-iron collar having a section that will mold a spigot end is placed in position, filled with concrete, smoothed with a small

trowel, and the pipe is finished. The forms were removed the following day, but the sections were allowed to sit on the iron base plate for five days before being turned over, being kept damp by repeated sprayings during this period. They were allowed to stand and cure for at least two weeks before being handled to any extent or placed in the trench.

Lowering them into the trench was accomplished by means of a movable wooden tripod from which was suspended a triplex chain hoist of one ton capacity, the heavier pipe weighing approximately fifteen hundred pounds per length. The laying of the pipe can be readily and rapidly done. The whole secret, if there be one, consists in having the bottom of the trench carefully prepared to the proper depth in advance; and in having each pipe laid accurately to line and grade so that the succeeding sections may fit perfectly, any inaccuracy in this regard making itself perceptible for several lengths. When a pipe has been placed in position the tie bands are slipped through the hooked ends of the longitudinal bars, locking the various pipes together; then a band of galvanized iron is fitted snugly around the outside of the pipes at their junction and the joint within grouted. The bands are pulled out as soon as the cement has set.

Conditions at the outlet render it essential, when repair work is in progress in the mill race, to temporarily by-pass the sewage through an open ditch around the head gates and into the creek below the dam. For this purpose a baffle gate, set in a concrete chamber three feet by three feet in section, was constructed from the ordinary 2x12-inch hemlock lumber around the work. It is eight feet long by three feet high and when closed lies flush against the sidewall, closing the by-pass opening; when opened it is swung across the chamber at an angle of thirty degrees with the side, opening the by-pass and closing the straight run. This gate is swung from three 12-inch strap hinges and held up to a clearance of one-eighth of an inch from the bottom, being supported at the outer end by a

CONCRETE PIPE "SEASONING."

LAYING CONCRETE PIPE.

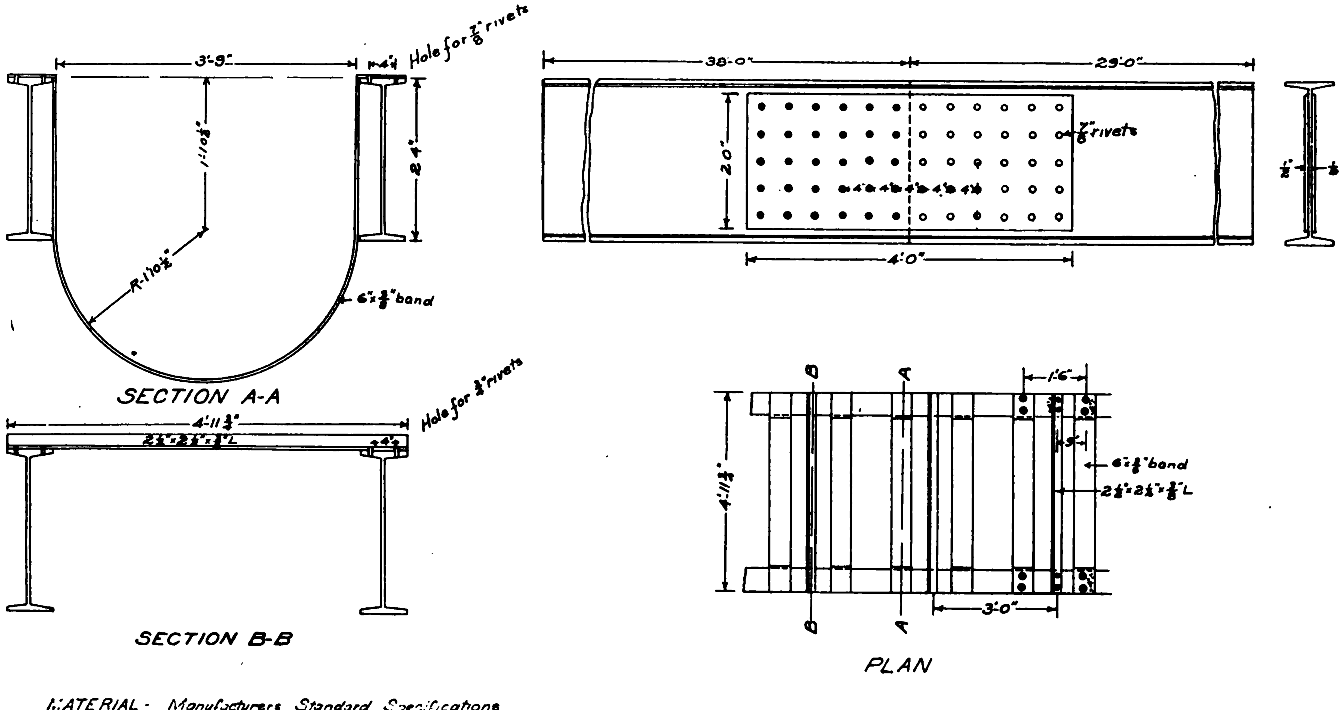
trolley wheel running on a curved piece of $\frac{1}{8}$x$1\frac{1}{2}$-inch bar iron set on edge in the concrete.

Above this point for several hundred feet the difficulties were chiefly a question of location, for this lay wholly in a piece of woodland under the care of the Park Commission, in consequence of which considerable maneuvering was necessary to get a suitable line and avoid tree cutting; however, at last, everything worked smoothly.

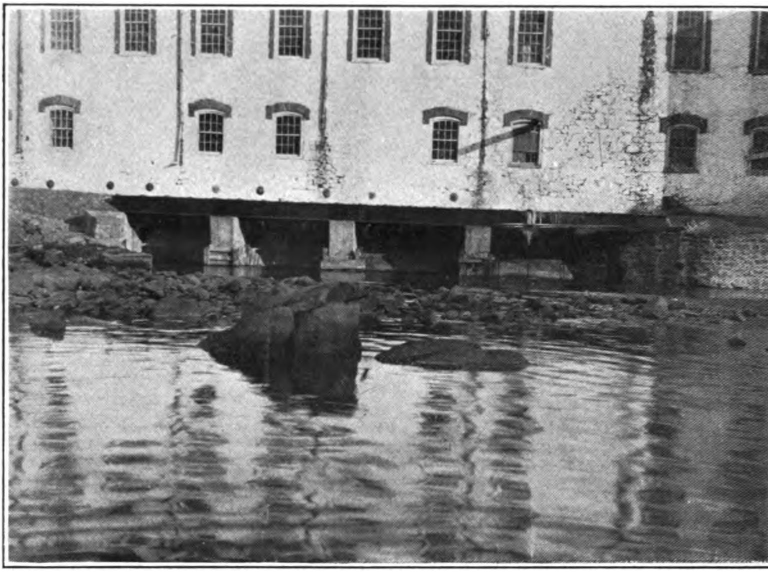
In the succeeding section we encountered the first real difficulty of the work; the line ran through the slope of an embankment of made ground, with settling ponds ten feet deep on one side and the creek on the other, rendering close sheathing and heavy bracing necessary. The slope made one side of the ditch several feet below the other, so that the tripod could not be used in the regular way. To meet this difficulty, on the lower side there was built a platform, braced in position by 6x6-inch struts to the level of the upper bank, and upon this the tripod leg was slid as the work progressed, a strip being nailed on the platform to prevent the kicking out of the leg and the upsetting of the whole apparatus.

When the work had progressed as far as the creek wall of the paper mill, the location of the line within three feet of the wall rendered necessary the abandonment of the tripod because of lack of sufficient room in which to spread the legs. Instead there was used here an A frame of 6x6-inch timber with the upper end resting against the wall, the chain hoist hanging from a cross timber between the legs and sufficiently far down from the apex of the frame so as to be over the center line of the pipe. This proved to be a very clumsy device to move, and it was planned to put wheels on the two legs and also at the top where the frame rested against the wall. For various reasons this was delayed and was never done and all the pipe in this section was laid with the simple A frame, excepting that portion which crosses the tail race of the mill.

At this crossing the conditions forced the design within such narrow limits as not to allow of any other solution except



DETAILS OF BRIDGE OVER TAIL RACE.



BRIDGE CARRYING SEWER OVER TAIL RACE.

OUTLET OF SEWER INTO RACE.

that of carrying the sewer in the air, over the race, a span of sixty feet. Further limitations prevented the use of an arch however flat and necessitated some steel construction. Very fortunately the mill owners allowed the building of three small piers in the race, thereby quartering the span; but in the calculations these were disregarded entirely as there exists a probability, however remote, of their being swept out by the ice during some spring freshet. Some small protection is afforded them by extending the abutment walls of the race a small distance toward the creek. The final design consisted of two 24-inch I beams, with 6x3/8-inch bands, eighteen inches center to center, bent so as to fit over and riveted to the upper flange of the beams, and with the lower portion rounded to the half section of the outside of the pipe. Every three feet of their length the I beams are fastened together by 2½x2½x3/8-inch L's riveted to their top flanges.

While it is expected that the joints will be tight and the pipe non-porous, an additional safeguard was provided in the shape of a trough formed by bending to the shape of the pipe sheets of No. 12 gauge black iron 48x72 inches in size, and placing the same directly upon the iron bands and then fitting the pipe closely into the bent sheets. All the steel work was painted a uniform color.

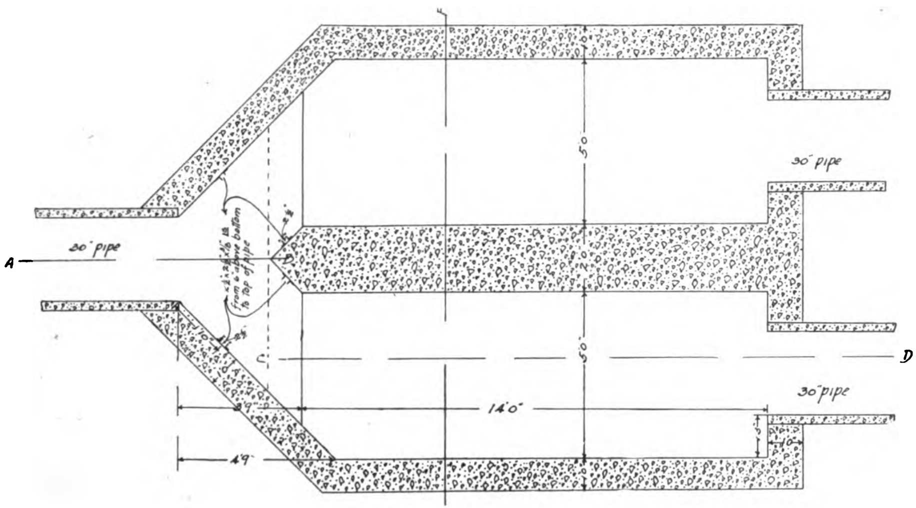
The piers, although small, presented some constructive difficulties which were annoying. The water was about five feet deep with quite a strong current flowing, and there was not sufficient space in which to build water-tight coffer dams. The box molds were built of 2x8-inch tongued and grooved N. C. pine pieces with their lower edges bevelled and driven hard on the rock bottom in an effort to make a tight joint and to exclude as much water as possible, but without any success in that line. Under these conditions good concrete work was secured by having the men stand in the water within the forms and, taking the concrete in buckets, dive under the surface and empty the buckets on the bottom or on the material already deposited, so as to prevent the separation of the mixture into

its component parts; sufficient ramming was secured by the tramping around of the men. This was carried on in successive layers until the water surface was reached, above which the concrete was deposited from barrows in the usual way and rammed.

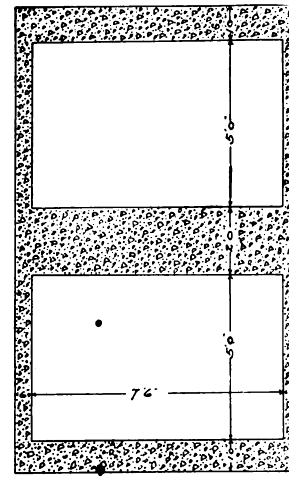
The steel work was placed easily by employing rollers on each pier. In laying the pipe at this point, both the tripod and the A frame had to be discarded, for the only available footing was the top flanges of the two 24-inch I beams spaced four feet center to center. There therefore was employed two cross frames fifteen feet apart, supporting an 8x8-inch horizontal hoisting timber from which hung the chain block. The frames were identical in design and consisted on each side of an upright 6x6-inch timber braced by two inclined strips of the same size, their lower ends being nailed to pieces of 2x6 securely bolted to the I beams, the upper ends of the posts being fastened together and braced by a cap of 6x6-inch timber upon which the hoisting timber rested.

The only other point of interest lies in the general outline of the inverted siphon, which deviated somewhat from the usual design, its profile bearing a striking resemblance to the edge of a saw. The regular grade of the 30-inch pipe was stopped about one hundred feet back from the upstream bank, where a vertical drop of ten and one-half feet was provided into a grit chamber which was fifteen feet in length and divided into two compartments. From this a double line of thirty-inch pipe led on an up grade of two per cent. for eighty-five feet to the edge of the water, ending in a manhole with a single thirty-inch outlet. It is expected that any sediment contained in the sewage which would deposit in the pipe will do so at this section, on account of the lessened velocity due to the upgrade and the additional area of conduit provided by the double pipe. This can be readily cleaned by closing one pipe and is easy of access at times of both high and low water.

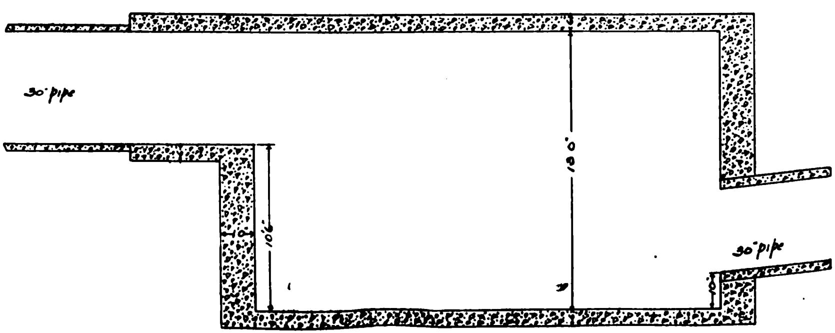
From here the profile was governed by topographical conditions and the character of the excavation, and consists of a



PLAN



SECTION -EF-



SECTION -ABCD-

OUTLINE SKETCH
OF
CONCRETE GRIT CHAMBER.
FOR
NORTH BRANDYWINE INTERCEPTING SEWER
SCALE ¼"·1'.

down grade of 4 per cent. for 250 feet under the creek bottom and a final leg on an upgrade of 6 per cent.; this last being of the larger size or 36-inch pipe. Considerations of economy dictated this course, a saving being effected in pipe on account of not running a double line for the whole distance, a saving in excavation which was in solid granite, but the main saving being in time, advantage being taken of a short, dry season to do the work, which would have necessitated an expensive coffer dam if prolonged to a time of high water.

DISCUSSION.

THE SECRETARY: I would like to ask Mr. Taylor what effect the acid had on the concrete in the tests referred to, that they had made on the concrete?

MR. TAYLOR: It had no effect at all. We took a piece of pipe that was defective in shape but not in structure, and immersed it for ten months—from October to July—and when it came out it showed no signs of pitting or other destructive effects at all. We tested the sewage as to acidity; that is, we were certain that it was acid; we didn't test the degree of acidity, but the sewage came by a paper mill where they use nitric acid. We noticed no effect on the sections of pipe tested.

THE MOSQUITO PROBLEM.*

By John B. Smith, Sc.D., State Entomologist of New Jersey.

It is a pleasure to me to get an opportunity to talk to the Society of Municipal Improvements. You have so many municipal engineers as members that I am glad to get a chance to tell them that on the whole, and as a body, they are responsible for more mosquito breeding places than any other body of men that I know of. The municipal engineer runs his streets and his general public works without any regard for drainage, and there follow in his wake sunken lots between street lines, in which water accumulates and where we have mosquito breeding places in quantity. I want to say for the engineer, however, that he is learning fast and that conditions at the present time are much better than they ever have been, although there is still some room for improvement.

The mosquito problem can be considered, indeed must be considered from two points of view. First, the mosquito as a nuisance; second, the mosquito as a menace to health. Although there are a large number of species of mosquitoes, very diverse in their life habits and in the places that they inhabit, as a matter of actual fact there are only a few species to which attention need be paid from the practical standpoint.

We have, scattered all over the country, two types that breed in fresh and more or less dirty water—the common house or rain-barrel mosquito, which is a nuisance pure and simple; the *Anopheles* mosquito, which is not nearly so abundant and attracts much less attention; but is dangerous, because of the fact that it carries disease. Both of these types enter houses whenever they get opportunity. Both of them live through the winter in our houses and both of them are closely connected with human habitations. If we were in the southern part of

* Illustrated by lantern slides.

the country I would add to this one other type, and that is the yellow fever mosquito, a species which is even more closely bound to human habitations, and which never occurs except in connection with human settlements. This has the same house-haunting habits that the others have, and it is, of course, even more dangerous because the character of the disease transmitted by it is more virulent than the malaria carried by the *Anopheles*.

Another type of mosquito that we have to deal with in this section of the country and all along the coast is that which breeds on the salt marshes, but does not stay there. As a matter of practice, large swarms abandon their breeding grounds and fly inland for long distances, and within the range of their flight they cover the country and make it almost uninhabitable. These species are not closely associated with man. They make no special attempts to enter houses, although they do get indoors when the way is clear for them, and they never live in the house during the winter. This type of mosquito is a nuisance pure and simple.

Taking up first the matter of the mosquito as a nuisance, he becomes so, because whenever he is present he limits outdoor enjoyments, particularly in the evening; he drives the individual under the shelter of a canopy or a screened porch, when he would much rather be outdoors, and frequently makes necessary retirement into the house when conditions are not nearly so pleasant as they would be outside. Of course, under such conditions, property depreciates in value, or rather it never appreciates, simply because no one wants it. There are large stretches in our State that are not densely settled, simply because of the prevalance of the mosquito pest—a prevalence that is not really necessary at all.

The character of the mosquito as a nuisance has been recognized by law in the State of New Jersey. Under the fundamental health law all waters in which mosquito larvae breed are declared to be nuisances and abatable by local boards of health. We have, therefore, in our State a power that is abso-

lute in the control of the mosquito pest, whenever the authorities choose to exercise that power. The difficulty is that the power is not fully understood, and it is not always recognized that the problem of dealing with the insects so far as local species are concerned, is on the whole rather a simple one.

All mosquitoes breed in water. There is absolutely no exception to this statement so far as I know, and certainly none among the species that are found in New Jersey, and we have not far short of fifty of them.

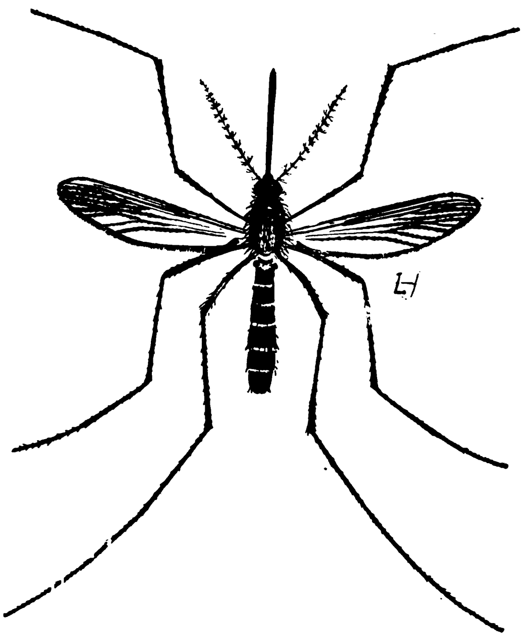


FIG. 1.
The Common House Mosquito, *Culex pipiens.*

The most common and widespread of all the mosquitoes that occur in this country is the species to which I have referred as the house mosquito; known also as the "rain-barrel" mosquito, or the "dirty-water" mosquito, from its breeding habits. This house mosquito may always be recognized, because it has no very distinguishing characters; that is, it is just a medium

sized, ordinary yellow mosquito without any bands to the legs or on the body, and without any markings that would be considered in any way distinctive. It lives through the winter in cellars, or sometimes even in upper rooms where they are kept cold. The places that it seeks are cold, a little damp and dark.

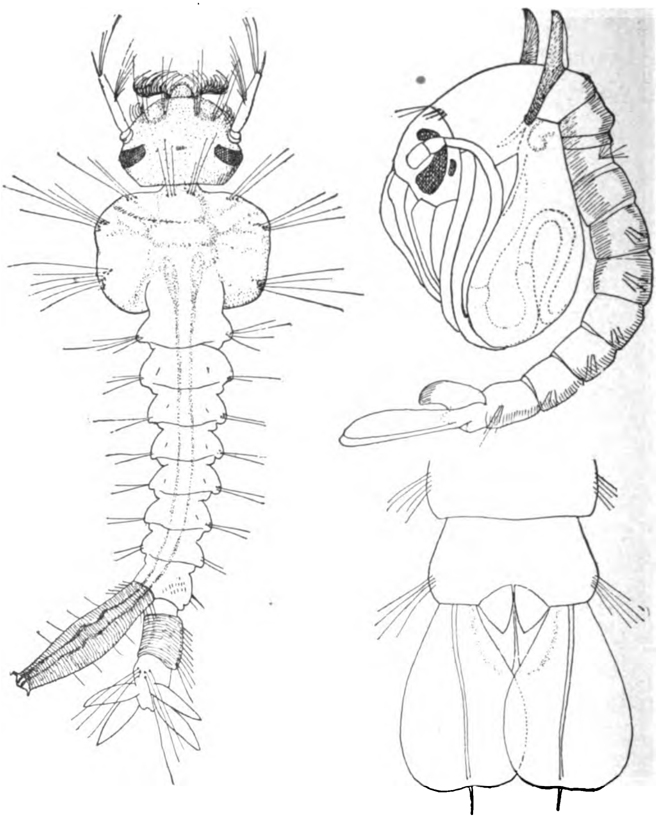
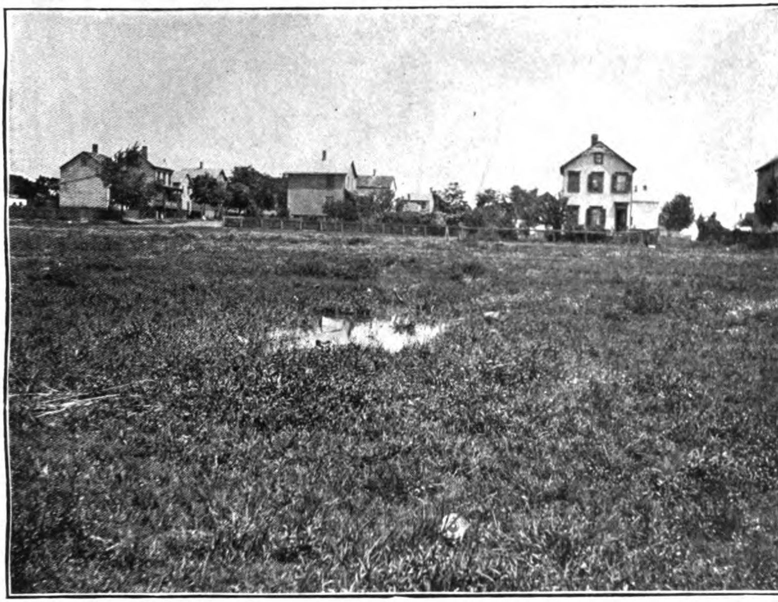


FIG. 2.
Larva and Pupa of House Mosquito.

In an ordinary dark cellar they are sometimes found by the hundred sitting along the side walls, and usually nearer to the surface of the ground than to the ceiling. In these cellars they remain until the uniform warmth of May brings them to activity and then they seek places in which to lay their eggs.



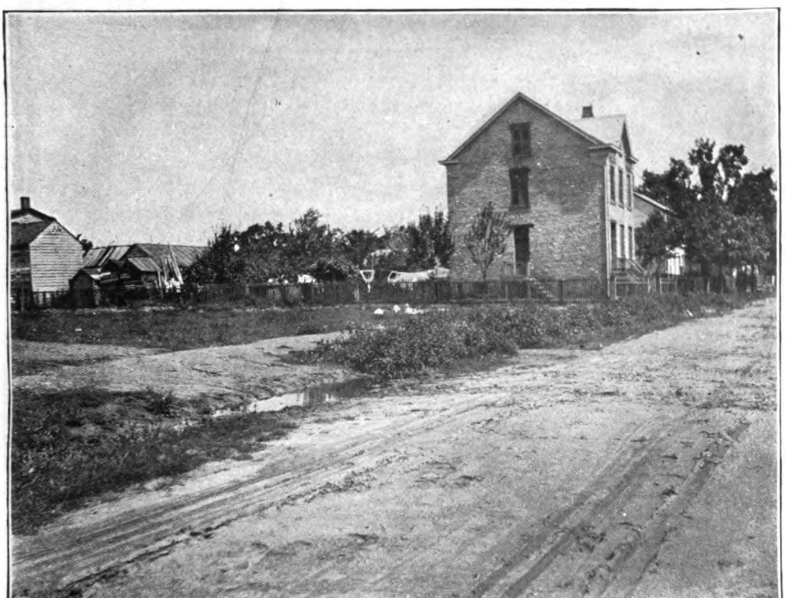


FIG. 3.

Typical breeding places. The upper figure represents a typical lot breeding pool from which thousands of mosquitoes emerge. The lower figure shows a neglected gutter, weedy, and with stagnant pools.

Now any sort of place that contains water will answer that purpose. It may be a puddle in a lot, a choked gutter, a cistern, a rainwater barrel, a cesspool, a manure pit, the water in a trap of a rarely used watercloset, or a sewer catchbasin. Anything, in fact, that holds water at all, even if there is only a cupful, may be used by the female as a place to lay eggs.

The eggs laid by this mosquito are placed in a mass called a boat, or a raft, containing anywhere from 200 to 250 eggs, and this raft floats on the surface of the water for 24 to 48 hours, or in cold weather even longer before the little wrigglers hatch by dropping out from the under side and swimming away into their native element. They feed upon the micro-organisms that are found in water. The mouth is furnished with a series of very fine hairs which are kept in constant motion, and which sweep into the gullet those minute creatures which we cannot see without the microscope, but which are sufficiently numerous to bring these wrigglers rapidly to maturity. If we were to place mosquito larvae in absolutely pure, sterile water they would starve to death. The dirtier the water, and the fouler it is from our point of view, the better these insects like it and the more rapidly they mature. Although they feed in water and depend upon the water for their food, nevertheless they get their air supply from above the water and depend for their oxygen upon what they can get above the surface. They are furnished, therefore, with a tube at the end of the body, which they are able to poke up through the surface and where they have a spiracle or breathing pore through which air is taken in. Cover the surface of the liquid in which the insect feeds with a film of oil and this will absolutely preclude the breathing of the wriggler. This can be easily tested by any one who chooses to make the experiment. No mosquito larvae can live in an oil covered pool.

Under normal conditions during the summer a week is sufficiently long to bring a mosquito larva to the pupal stage, a stage intermediate between the wriggler and the perfect mosquito, and which is also passed in the water. This stage lasts

only a matter of a day or two and then the mosquito emerges, leaving the empty shell floating in the water like a wrecked boat. It takes only a few minutes for the adult to become dry and fitted to its aerial mode of life, and within twenty-four hours it is ready for a feast of blood, if it is a female. The males have the mouth parts so slightly developed that they are not able to puncture animal tissue and are confined for food to the nectar of flowers; but the females are differently fitted. There the lancets are sufficiently developed to puncture even the thickest skin so that the insect can reach blood and feast upon it.

There are a number of broods of this species in the course of the summer and about mid-summer, when the weather is hottest and when it is necessary for them to develop rapidly because frequently the pools in which they live last only a few days, there is a brood or two of unusually small, dark-colored forms. These are vicious out of all proportion to their size, and they seem to make a special effort to get indoors. Screens are not always a protection against these insects, simply because few screens are properly put in. Occasionally, too, they make a direct effort to get through the meshes of wire screens, and a great many of them succeed. There are usually a few evenings during the summer when this sort of attack is made, and then a little brushing with oil of citronella, or even kerosene, over the wire netting will serve to keep them out.

In cities and towns, catchbasins are among the most prolific sources of mosquito supply, and a good many catchbasins are constructed in such a way as to absolutely favor the development of mosquitoes within them. The illustrations of the village and common city type of catchbasin show just how these basins work and how during a dry period when the basins are not frequently flushed, breeding can go on almost without check. It is quite possible to construct a basin in such a way as to prevent this sort of breeding. This type of basin was tested in Newark during the summer, and it was found that no matter how large the volume of water that came into it, a film

of oil could be maintained so that no breeding was possible for several months in succession. This is the particular species of

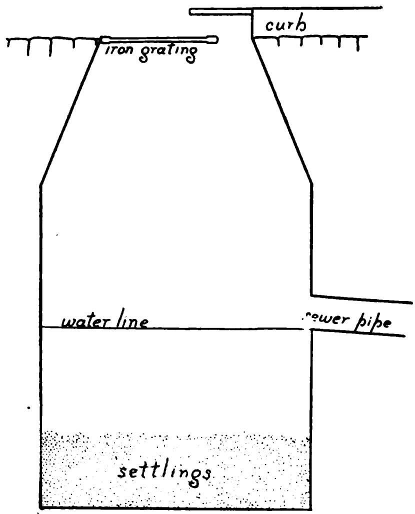


FIG. 4.
Mosquito-Breeding Catch Basin.

mosquito that is most generally to be dealt with by municipalities and by the municipal and sanitary engineer.

The second type of house mosquito is the *Anopheles* or malaria carrier. This differs from the previous type in all stages and in its life history. It has the same habit of getting indoors and living with human beings, but it is larger, the legs seem to be longer and the body more slender. It differs at once by having the wings spotted, so that when the two are laid side by side on a sheet of white paper, the difference between them is at once apparent. They live in our houses through the winter and they rest on the walls in the cellars in just about the same way, but in a totally different position; for if we examine a *Culex* and an *Anopheles* sitting side by side on a wall, we find that the *Culex,* or common nuisance, has its body parallel with the surface upon which it rests, while the *Anopheles* has its body at almost right angles to the same surface, the head poked down between the first and second pairs of legs.

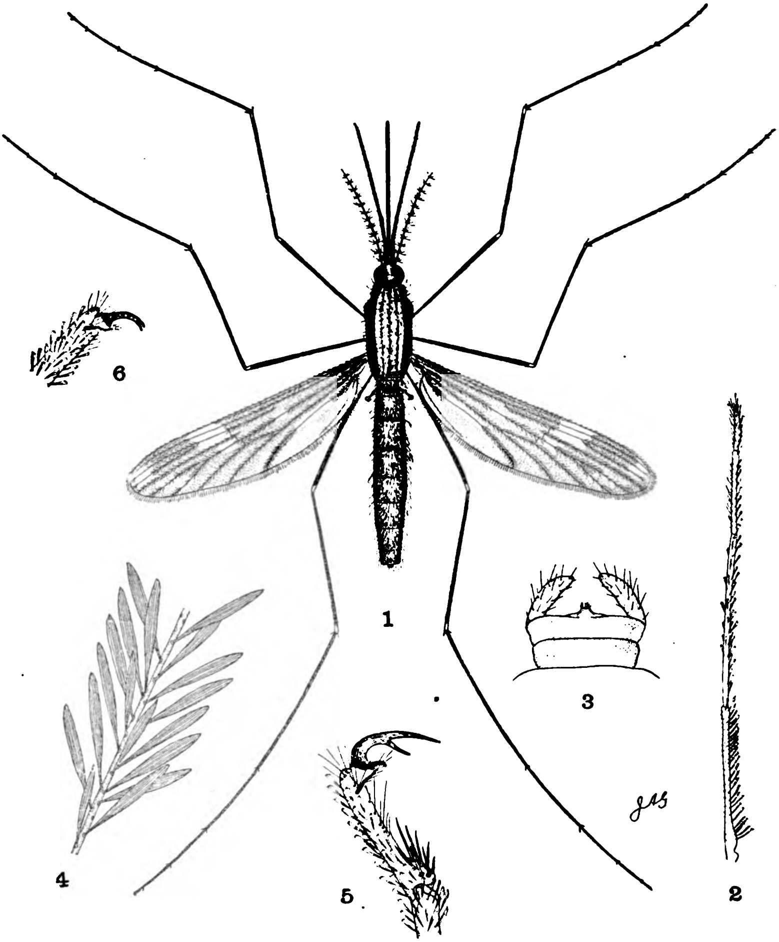


FIG. 5.

Anopheles Punctipennis, with Details of Structure. 1. Female adult; 2, her palpus; 3, genitalia; 4, part of wing vein, showing scales; 5, anterior; and 6, middle claws of male. All much enlarged.

This mosquito also makes its appearance as soon as the weather turns warm in spring and begins to lay eggs, but it has a decided choice as to the place where eggs are to be laid. It will not select foul water and it prefers not to select small water areas. The preferable places are in the grassy edges of

a pond or large pool, or along the edges of a sluggish ditch, and any open water generally which is shallow, and in which there is some vegetation. At a pinch they will lay their eggs in rain barrels and in small pools in a back yard. They have also been found in pails and even in tin pans, but they will take to such places only if they can find nothing more suitable. You never find them in sewage, and they never breed in catch-basins; nor do they occur in cesspools, manure pits or any really foul water, so that the range of breeding places for *Anopheles* is very much more limited and the insects themselves are never so abundant. Although the eggs are laid on the surface of the water, they are never laid in a boat nor in masses. They are furnished with processes on the sides that act as floats, and keep them on top until the larvae, or wrigglers issue, and these wrigglers also differ very materially from those of *Culex*. They have a much shorter breathing tube at the end of the body, but they depend for their oxygen upon air in the same way that the other mosquitoes do. Their habit of feeding is different, for while the *Culex* wriggler brushes out those micro-organisms that live in the water, the *Anopheles* larva brushes off those spores and other organisms that fall upon or float on the surface of the water, so this larva lies on and does not go beneath the surface, except when disturbed. This habit makes it possible for the insect to live in shallow places and occasionally even on thin films of water on the top of a lily leaf or places of that character. They can get where fish cannot get, and a choked-up pond or one with grassy edges, even if inhabited by fish may breed these malarial mosquitoes in considerable numbers. They are never found in swiftly running streams, but in streams in which there are many quiet

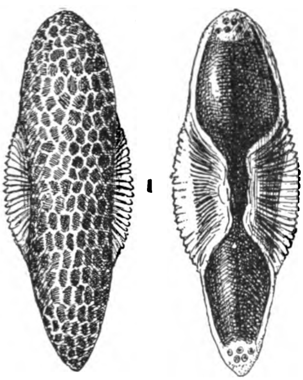


FIG. 6.
Eggs of Anopheles.

pools or grassy enlargements the insects succeed in maintaining themselves, and so these species will be found where the common *Culex* does not occur, although in smaller numbers.

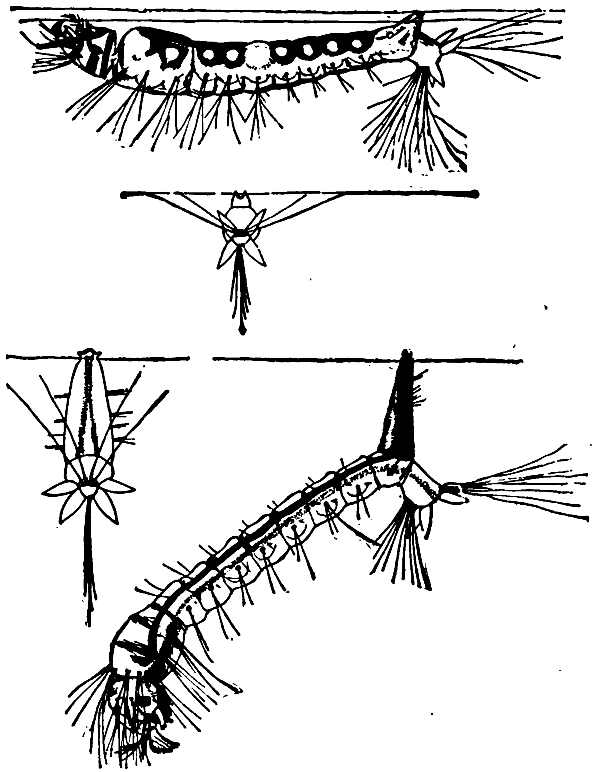


FIG. 7.
Differences between *Anopheles* (upper) and *Culex* (lower) wrigglers, in position and form.

In the pupal stage there is very little difference between *Anopheles* and *Culex,* and the differences are not as apparent, although easily recognizable by the specialist. It usually takes a little longer to develop, and two weeks is a good deal nearer to the average period than the one week into which the life cycle of the *Culex* may be crowded.

I have several times referred to *Anopheles* as being a malaria carrier, and it may interest you to know how this disease is

transmitted by the mosquito. It is not a direct transfer from one individual to another, but it is a case of an intermediate host, the *Anopheles* being as much a sufferer from the disease as man himself. The organism that causes malaria is one of the lowest animal forms, a single-celled animal which propagates by means of spores. This animal lives and grows in the red corpuscles of the human blood, and in that stage is known as a Plasmodium. The human being infested with malaria has a very large number of these minute animals in the red blood corpuscles of his body. It takes the organism that causes the ordinary type of malaria, or chills and fever, forty-eight hours to come to maturity. When they do, they divide up into spores, break up the corpuscle in which they have been feeding, and the spores are liberated in the blood serum. As this takes place all at one time, it upsets the body temperature and the patient has a chill. These spores float in the blood serum for only a short time and then make their way into other red blood corpuscles and while they are doing that a rise of temperature occurs and the patient has the fever that follows the chill. This may go on for a considerable period if not checked by drugs, and may result in the death of the patient.

After a period of such reproduction other bodies, however, are formed besides spores. They differ in appearance, being somewhat larger, and when discharged into the blood serum they make no effort to get into fresh blood corpuscles. On the other hand, they continue floating about and have a tendency to get into the circulation that extends to the surface of the body. These are the gametes and they are waiting to be taken up by some blood sucking insect. If they are taken up by any sort of insect, or even if a little of the blood is taken out on a warm slide and observed under the microscope, it will be found that development begins, and from some of the gametes little processes or tails are produced which break off, unite with the unchanged gametes and there you have a conjugation of the

male element represented by the broken off processes, with the female element represented by the unchanged gametes.

Now this is as far as development will go anywhere outside of the stomach of an *Anopheles* mosquito. If, however, the malaria patient has been bitten by an *Anopheles* mosquito, conjugation takes place in its stomach, and a further development ensues. There is a change in form, the creature becomes worm-like, and is therefore called a vermicule. This makes its way through the tissue of the mosquito stomach to its outer coating and forms a little swelling that is known as a Zygote. This Zygote gradually increases in size and becomes filled with an enormous number of minute rod-like structures, which are known as blasts. In about ten days these Zygotes burst, the blasts are liberated into the body cavity of the mosquito and they make their way to the salivary glands. Next time that same mosquito bites, it discharges a drop of saliva into the wound, introduces also a number of these blasts, and if the individual is a susceptible one, a case of malaria is started.

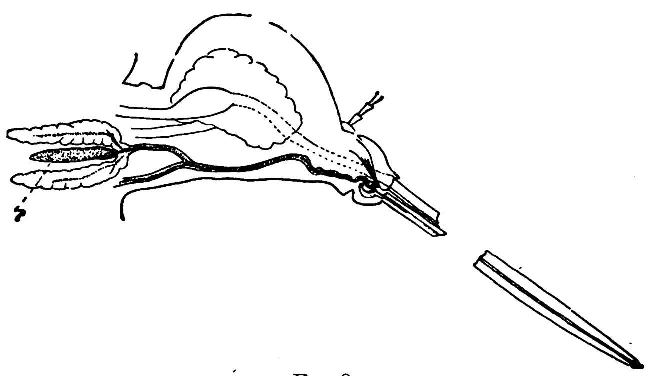


FIG. 8.
Section of head of *Culex,* showing location of poison gland at p.

When a mosquito bites, the first thing done is to put a drop of saliva into the wound to liquify the blood. The blood, as it circulates in the human body, is too thick to be taken up through the extremely fine tube of the mosquito mouth, and the salivary secretion is intended to liquefy it. It is this liquefi-

cation of the blood that produces the swelling and inflammation which accompanies the pain of a mosquito bite. This matter can be tested very readily by any one who will allow a mosquito to become gorged with blood on the hand and will kill it before it flies away. The blood smear that forms on the surface of the hand from the crushed body of the mosquito should be allowed to dry. A little scratch should be made with a needle nearby, so that a single drop of blood will ooze out that may be also allowed to dry. When both are dried, if the finger be rubbed over the smear from the mosquito body, the blood will break up into a fine powder or dust. If, on the other hand, the finger be rubbed over the drop from the scratched surface, it will be found that here there is a tough clot that will not break up into a powder, but that forms a sort of rubbery mass. The mosquito saliva prevents the formation of such a clot in its own body.

Although the life history of the insect is so different in some respects from that of the *Culex,* nevertheless the same general measures of destruction will apply. Even with *Anopheles* a film of oil over the surface of the water will kill all the larvae that are in the pool treated in that way.

I wish to guard myself at this point from the belief that I recommend the application of oil to kill mosquito wrigglers under all circumstances and as a complete remedy. It is a remedy, but it is a temporary one and is to be considered as a palliative. In every case, so far as possible, the breeding places should be destroyed, either by filling up the depression, if that can be done, or by cleaning the edges of pond, pool or stream when such a one is in fault. Very frequently all that is necessary is to cut out some of the vegetation in a pond so as to make all parts of it accessible to fish, and sometimes the introduction of a few small fish will be all that is necessary, if the pond or pool is of any depth and is inhabited, for instance, by gold fish only, that cannot get into shallow places. My recommendation is in every case, destroy the breeding places, or make them inaccessible to the mosquitoes. Use the oil only when nothing

else is to be done. It is good, but its results are not permanent, and the infested pool will have to be kept under observation continually in order to prevent later developments.

Some time ago I referred to the fact that along the line of the Atlantic coast there was a type of mosquito that did not stay where it bred, but migrated for some distance inland. I might have said that this same condition of affairs extended not only along the Atlantic coast, but along the Gulf, and to a somewhat less extent along the Pacific coast. There are also a few inland species that have a tendency to migrate or fly away from the place where they were born and bred.

The offenders in New Jersey, where I have made my studies on these pests, breed in the salt marshes that fringe a large proportion of our sea coast from Jersey City to Cape May, around the Cape May peninsula, along the Delaware bay and up the Delaware river as far as Salem creek. These salt marsh species breed nowhere else, although they may be found as a pest almost anywhere throughout South Jersey, and although they extend back from the coast anywhere from twenty to forty miles. It is quite possible, therefore, that localities that contain absolutely no breeding places of their own, may be periodically flooded with swarms against which they are helpless, so far as local work is concerned.

The life history of these insects is curious in a number of ways. In the first place, unlike the other species of which I have spoken, the eggs are not laid on the surface of the water. They are laid in the moist mud of the salt marsh, usually in depressed areas where water is likely to come at some time, and these eggs may remain on the marsh not only for days or weeks, but for months and even years. How long an egg may survive on a salt marsh we do not know definitely. We do know definitely that it may survive for at least two years, and the probabilities are that it will live for three years, and yet that, too, is guesswork. We do know, also, because I have tested it by direct experiment, that eggs covered with water immediately after they are laid will not hatch. They will

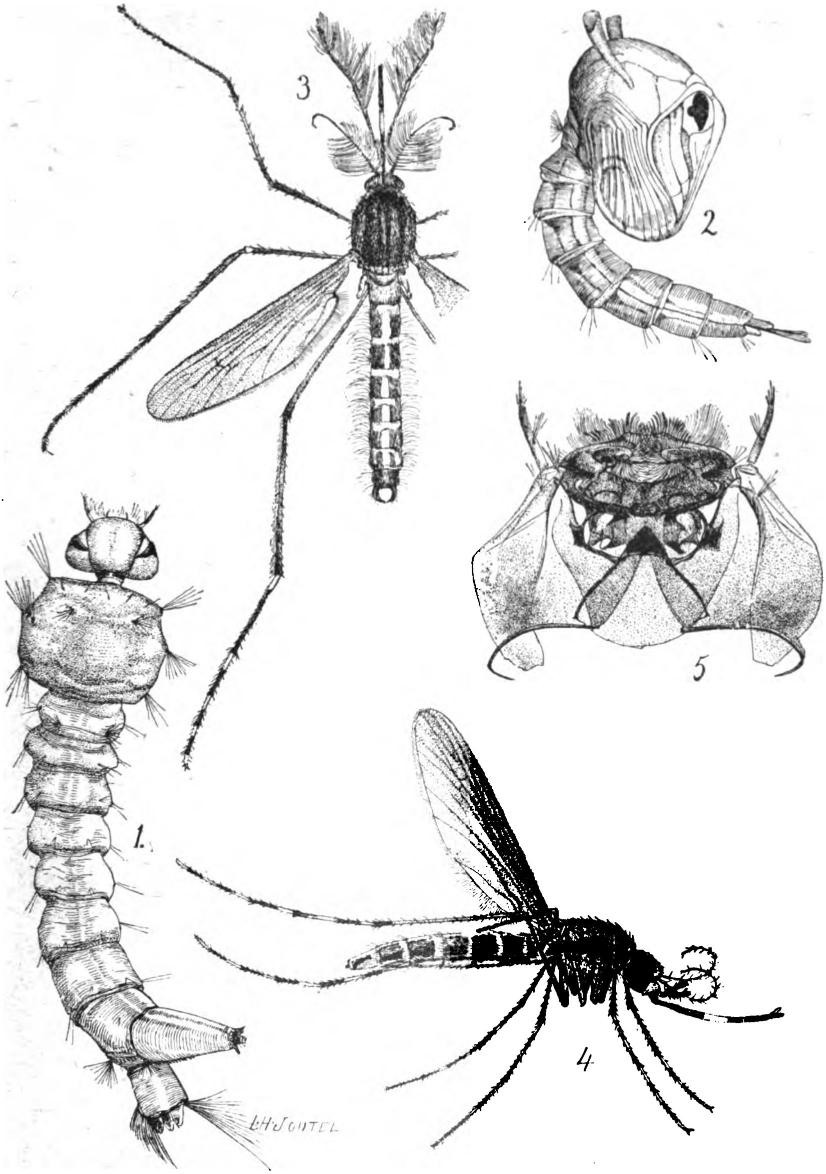


Fig. 9.

Larva, Pupa and Adult of the Salt Marsh Mosquito, *Culex sollicitans.*

remain unhatched until they have been dried out. They may be kept dry for months without a particle of water. Once upon a time I took a sod from a salt marsh in South Jersey, brought it to New Brunswick and kept in my laboratory dry, for three months. Whenever I wanted a lot of larvae I cut off a section of sod, put it in water and anywhere from an hour to three or four hours afterward I had a lot of young wrigglers. In other words, it is necessary for these eggs to dry out at least once before they are in position to hatch, and even then not all the eggs hatch the first time they are covered with water. Some of them may become water covered and dry out and become covered again, and this may occur several times before all the eggs on a sod have finally developed.

Now this is a provision of nature for keeping up the mosquito supply, because if every egg hatched the first time it was covered by water, it might conceivably happen that the entire marsh might be covered with water that would drain off within a shorter period than is necessary to allow the larvae to come to maturity. It matters very little to the larvae of these salt marsh species whether the water with which they are covered is salt or fresh. The essential point is that their food consists of those micro-organisms that develop on a salt marsh and on a salt marsh only.

The ordinary history is about like this—that during the summer the marshes become loaded with eggs from the broods that hatch. During the winter the marshes freeze, become covered with snow, and what, with storms and otherwise, the ground is thoroughly waterlogged. Early in May everything melts; we have a series of spring tides, especially during the period of full moon, and the marshes become covered with water to the extreme edge of the highland and every depression is water filled in such a way that it will require many days to drain away under ordinary natural conditions. Just as soon as this water warms up in the least, a very large percentage of the mosquito eggs on the marsh hatch. We get our first brood of wrigglers that come into the pools during the early days of

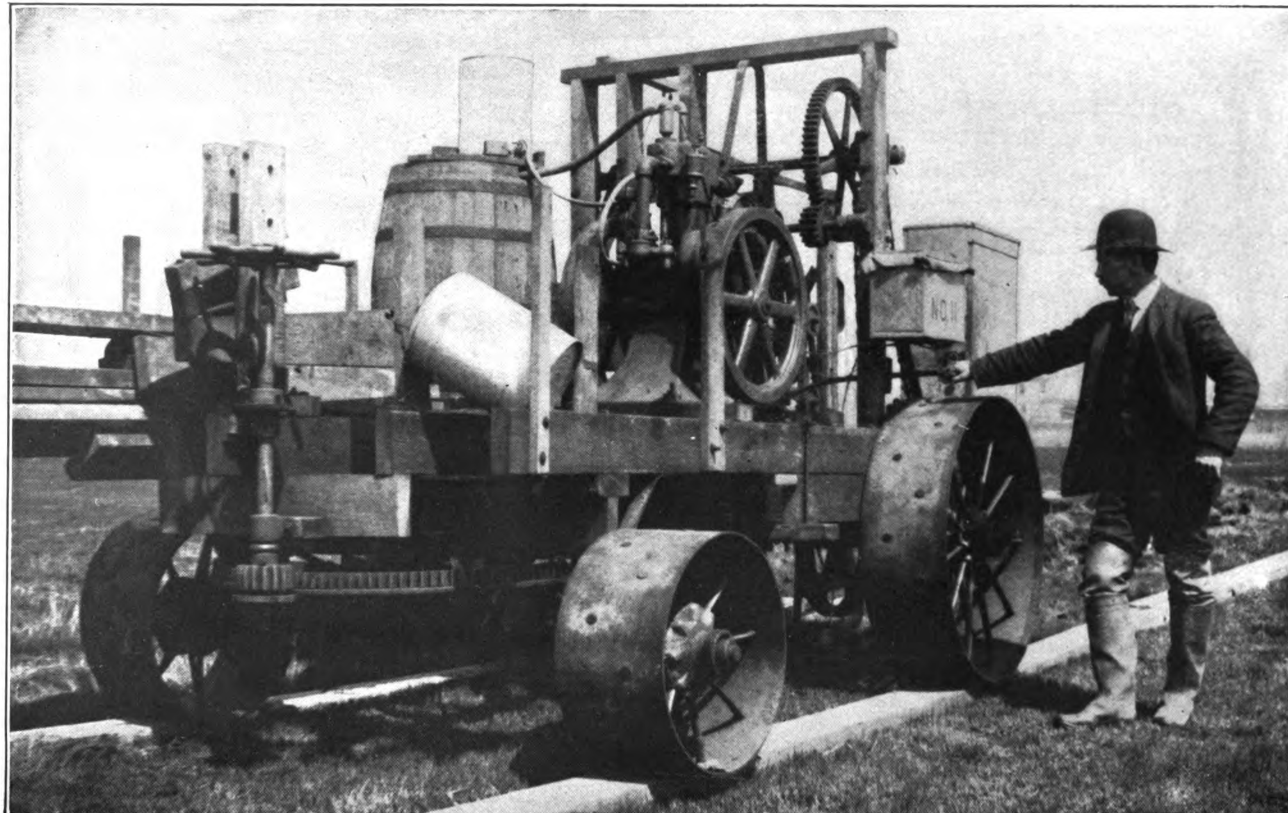


FIG. 10.
A Power Ditcher in Use on Salt Marshes in New Jersey.

May, and by the 15th, or thereabouts, depending, of course, a little upon the season, the first brood makes its appearance. The great bulk of these mosquitoes remain on the marsh only for a day or two; there is some mating and a considerable number of females do not get away. Of the males nothing is seen after the first two or three days. Then there comes a warm, quiet night, and as if by concerted action, mosquitoes rise from all parts of the marsh and fly and drift inland. Some time before midnight those persons who are on the streets find that cities within a few miles of the shore are suddenly flooded with mosquitoes where none were the day before, and early risers find them everywhere in the gardens and in the parks, and the first mosquito invasion of the season is on.

Where there are no settlements the insects may fly for several days in succession, getting further and further inland with each flight, and so I have traced broods all the way from the shore nearly across the State. The greatest distance of any of the flights that I have myself observed is forty miles. The average is much less than that. Now, as a matter of interest, these flights are taken by females only and they are taken by females that have never been impregnated and that never reproduce their kind. They leave the place where they are developed; they fly apparently in search of food and when they have found it they seem to lose all idea of returning and simply remain where fate has carried them. After a longer or shorter period they die.

The question is often asked, how long does a mosquito live? That depends altogether on circumstances. I have already told you that some of the species live throughout the winter. Those that appear in September and October may live until the following May. Ordinarily a female hatches, gets a chance at food, mates, and within a week or ten days afterward lays her batch of eggs. When that is done, her work is accomplished and ordinarily she dies. If for any reason she does not find a place to lay eggs, she usually lives until she gets an opportunity to place them. This may be two or three weeks, or even a

month, and during that time an individual may bite several times. It is essential in the case of *Anopheles* that an individual bite at least twice in order that malaria may be transferred from one individual to another, and that biting must be done at intervals of ten days. In the case of these migrating mosquitoes, as the female does not lay eggs, an individual may live for three or four weeks and may bite several times.

There is a series of mosquitoes that breed in woodland pools, and these have usually only a single brood in the course of the season. They are early birds and usually make their appearance by the middle of May. They may appear in very large numbers; may fill the woods, and stragglers may yet be found until well along in August. Ordinarily, in the open regions of South Jersey, and in general within the range of the migratory forms the individuals of one flight live until another takes its place, so that after the insects have once made their appearance there is a continual succession of them throughout the season.

To return to our salt marsh species—these, much less than the upland mosquitoes depend upon rains and storms. In the ordinary course of an average season there is a series of high tides at every full moon. These high tides usually suffice to cover a considerable portion of the lower marsh land, and if an east wind or a shoreward wind of any kind accompanies such a tide, a larger proportion of the meadow is covered. As far as these tides go and fill the pools, eggs are hatched and wrigglers make their appearance. Sometimes the tides, besides filling the pools, bring up great quantities of killies, and wherever even a single killie gets into a pool, it means that there is no possibility of mosquito development. So I have known a number of occasions where very heavy tides have filled all the pools in the meadows without its meaning a heavy brood of mosquitoes. This was not because there were no eggs, nor because the eggs did not hatch, but simply because there were plenty of fish to eat up all the wrigglers, and only a small percentage of a brood developed.

FIG. 11.
Sods Cut by Ditching Machine (30"x6"x10") Lying Alongside a Ditch on Salt Marsh.

Now there is another curious condition of affairs connected with a small brood, and that is, with a small brood there seems to be much less tendency to migrate, so that the smaller brood remains on the meadow and most of these lay eggs or reproduce their kind.

There seems to be no limit to the number of broods that may be produced on a salt marsh, but usually six or eight may be counted on in the course of an ordinary season. We usually have the first by the middle of May. It is not unusual to have a brood as late as the first of October. I have known them to hatch in quantity up to the middle of November.

It is fair to say that fully 90 per cent. of all the mosquitoes in the State of New Jersey breed on the salt marshes, and that the so-called "New Jersey mosquito" is the salt marsh mosquito. Therefore the campaign in the State has been directed against this particular type rather than against those forms that breed in fresh water.

It is very obvious that in treating an extensive area of mosquito land such as we have in New Jersey, palliatives are altogether out of the question. The only thing that can be done is to deal with the marshes in such a way as to prevent breeding, and that we have found it possible to do by digging parallel ditches at varying intervals, usually not much less than 200 feet apart in such a way as to permit all the water to drain from a marsh area after it has been once flooded in a period of time less than that required for the mosquitoes to come to maturity. Of course, lands that are covered at every tide require no treatment. Under such conditions mosquitoes cannot develop. It is only such marshes as are irregular and become occasionally covered that are dangerous from the mosquito-breeding standpoint. These salt marshes usually consist of a layer of turf that varies from one to two feet in thickness, and that really forms a huge sponge from which the water runs very readily whenever it is given an opportunity. Below that is a bed of sand or clay or mud, as the case may be, and our ditches are carried down into this underlying bed for a

distance of at least six inches wherever it is possible to do so. Our ditches are not very wide, because we find that there is no need for it, and because also in our experience wide ditches show much more tendency to clog and to grow up than narrow ditches. So our ditches are made ten inches wide and thirty inches deep, and they are cut with tools that give us perpendicular sides and a flat bottom. These tools have been especially developed for work on the salt marshes and they consist of hand spades and a power machine weighing two tons or over.

The effect of this ditching is to run off the surface water usually within forty-eight hours after the marsh has become covered and to absolutely prevent mosquito breeding over the drained territory. We find also that the marsh lightens and lifts under this treatment. All our ditches are connected with tide water and the tide ebbs and flows in them. They can never become dangerous from the mosquito breeding standpoint, because fish run up to the very heads of the ditches, and because no eggs are ever laid in places of that kind by mosquitoes.

We find also that within a year or two after the marshes have been drained the character of the vegetation changes; the sedges and coarse grasses are crowded out by the salt grass and black grass, and what has been a valueless piece of meadow becomes a source of income, producing anywhere from one to four tons of hay, which, when the marsh becomes sufficiently hard, may be harvested by machine and sells at anywhere from five to eight dollars per ton. The influence of our work is, therefore, two fold—we get rid of the mosquito-breeding pest, and we improve the value of the property directly. Incidentally the value of the surrounding territory is also improved, because people will come and live on it; and along the New Jersey shore getting rid of the mosquitoes means an addition of many thousands of dollars to the summer resorts each year, and the building up of many places that have languished in the past.

FIG. 12.
The Skinner Ditching Spade.
Cuts a Sod 10 Inches Wide and 30 Inches Deep.

Briefly, the mosquito campaign has now been carried on to such a point that it is possible to say that while extermination is not to be looked for, the practical control of mosquito breeding is within reach of every community, and that there is no reason why more than an occasional mosquito should be found within the State of New Jersey, or anywhere else where similar campaigns are to be carried on.

There is no better example of what can be done than the work that has been carried on in the canal zone at Panama, and what can be done by one authority can surely be done by another.

REPORT OF THE COMMITTEE ON PARK DEVELOPMENT AND MAINTENANCE.

Chairman, James Owen, Montclair, N. J.

The committee itself hasn't very much to say. Last year there was quite an extensive resume of park development written out, and the committee thought that this year it would be better to have the views of the other members of the Society in the shape of papers.

One or two thoughts, however, connected with this park question I would like to bring up here. Last year I suggested as a thought that it might be possible for special classes in the public schools to be taken out to the parks and educated in the culture of flowers or horticulture, and also in the studies of animals, fish, etc. I was very much gratified and somewhat surprised the past year to find that this suggestion was being made use of by the boards of education, and has taken hold of the western cities quite strongly, the idea being much commented upon.

The next thought is that nowadays large areas of reserves are being established by different States and the national government, and those reserves could be used to practical effect by turning them to a large extent into game preserves. To that extent there would be a great deal of amusement and exercise and pleasure afforded to citizens of this country who now have to travel far away from home and spend a great deal of money to get things they might get nearer home.

Another thought is that the question of decoration of the streets of towns and cities outside of park development should be agitated. This is entirely a matter of education, and of course is hardly possible in congested business thoroughfares; but in all residence streets the owners and residents should be inculcated with the idea that so much of the street as is their special prerogative, the sidewalk, should be considered part

of their domain and should be regulated and decorated and kept in good shape by the individuals themselves. You all appreciate the fact that a street that is carefully garnered and watched throughout its whole width is much more pleasurable, much better for the community, and gives a greater tendency for order and care by the children along it than a neglected thoroughfare.

There will be two papers read tonight, one by Mr. Reynolds, who will give the history and ideas of park development in Essex County; and another by Mr. Solotaroff, who is the secretary and superintendent of the Shade Tree Commission of East Orange, N. J., in which he will give his ideas of the manner and mode of developing and beautifying the highways by means of shade trees.

PRACTICAL RESULTS OF THE MUNICIPAL CONTROL OF SHADE TREES.

By William Solotaroff, Secretary and Superintendent, Shade Tree Commission, East Orange, N. J.

Two years ago I had the privilege of writing a paper on "The Municipal Control of the Planting and Care of Shade Trees," which was kindly read by Mr. William H. V. Reimer, our City Engineer, at the Birmingham meeting. The paper brought forth a great deal of discussion. It seemed to be recognized that the problem presented was such as exists in every municipality; and this method of dealing with the problem appeared admirable. While the idea of the municipal control of shade trees is not new, it is only during the last decade that the benefits derived from such a system have become generally recognized. The State of New Jersey has been the pioneer State of the Union in the successful application of the system of the public control of shade trees and at this time the plan is no longer an experiment. We are now able to show results. In the State of New Jersey more than a dozen cities have now established Shade Tree Commissions. Among these are Newark, Passaic, East Orange, South Orange, East Rutherford, Camden, Jersey City, Morristown, Plainfield, Ridgewood and Perth Amboy. The State of Pennsylvania last year passed a law drawn after the New Jersey statute, providing for the establishment of Shade Tree Commissions in municipalities. During the last few years our Commission has received scores of letters from cities all over the country asking for information regarding our organization and methods of work. These things show that the matter of handling of the street trees is one of the most important municipal problems of today.

It will not be necessary this evening to enter into a discussion of the importance of having the streets of our cities well shaded with handsome trees. Briefly, the advantages of such

Showing the result of injury to trees by horse-bites.

Another example of the result of injury by horse bites when trees are left unprotected by guards.

NOTE—The illustrations accompanying this paper are from photographs taken by Mr. Solotaroff, and are used by permission of the Shade Tree Commission.

an improvement may be considered under three heads—from the esthetic, sanitary and economic standpoints. In these days when so much is being done to bring about the realization of the City Beautiful, shade trees play a very important part. No city in America possesses such avenues of fine shade trees as the City of Washington. While visitors admire the fine public buildings, everyone will admit that the chief attractions of Washington are the beautiful avenues of shade trees which make it one magnificent park. From the viewpoint of health, we need but recall a few well known facts. Trees help to purify the air by absorbing the carbonic acid gas that is exhaled by man and giving back the pure oxygen that he needs. Trees also help to modify the temperature of our streets. The normal heat of summer is still further intensified in cities by the reflection from the pavements and the buildings. The economic value of shade trees is inestimable. They are among the first things that impress a stranger in forming a judgment as to whether a city is or is not a good place to live in. At this time, when from all the large cities people are flocking to the suburbs, there is a great desire to make these places as country-like as possible. The intelligent selection of tree species, their planting and care become as important as other improvements.

It will be a very easy matter for you who are concerned with municipal work to picture in your mind a street, or a number of streets in your city where the system of the individual control of trees exists. What picture does such a street present? There are long stretches that are not planted at all. The trees that have been set out bear evidence of the diversity of taste of the planters. There are half a dozen or more species of trees on the street, undesirable mixed with desirable, of all shapes and sizes, set either too close or too far apart. In some cases the trees are not trimmed at all and the limbs are so low that they touch the heads of pedestrians; in others they are pruned too high. The trees have been left unprotected by guards; many of them have been bitten by horses and there is evidence that they have been injured by destructive pests.

Especially in the control of insects which infest certain species of trees from time to time, the system, or rather the lack of system, of individual care of street trees utterly fails. The citizen is entirely powerless to accomplish anything. His efforts come to naught if his neighbor allows the pest to remain on *his* trees. In the extermination of insects in a city it is absolutely necessary that all the infested trees be treated in order to obtain effective results. It is impossible to have concerted action on the part of thousands of people of a community in the treatment of infested trees at the same time. Insect fighting requires persistence and a knowledge of what to do at the proper time to obtain results. There is a period in the life history of every one of our tree pests when it may be most easily destroyed. This stage is not always at the time when the most injury is apparent or when the average citizen wakes up to the necessity of doing something. The life history of the pests must be known in order that treatment may be given at the right time. Besides, to spray trees of considerable size, requires an apparatus which the average citizen cannot be expected to have.

The inadequacy of the plan of leaving street trees to the control of individuals is becoming generally apparent and a great many cities are striving to inaugurate a system which will place the street trees under the control of one official, or a commission or other organization. Among the cities of this country which offer good examples of the successful results of the municipal control of street trees is Washington, where for more than a quarter of a century the street trees have been under public control. The charter of Greater New York placed the planting and care of shade trees in the hands of the Park Departments. Other cities have city foresters, or committees of members of the common councils to look after the trees.

The best solution by far of the problem of the planting and care of shade trees is provided by a law of the State of New Jersey of 1893, and a law of the State of Pennsylvania of 1907. These acts provide for the establishing of Commissions to take

charge of the planting and care of shade trees on the highways of the municipalities of the respective States. These Commissions are composed of three members appointed for terms of three, four and five years and serve without pay. It is optional with the governing body of any city whether these acts shall have effect there. When, by resolution of the City Council, it is decided that the law shall become operative in a city, then from that time all matters pertaining to shade trees are placed in the hands of the respective Commissions. All work is carried on in a systematic way and trees are planted, pruned, sprayed and removed under direction of the Commissioners. As practically operated the Commissioners serve as an organization and they employ a professional forester who has charge of the executive work. Wherein these Commissions differ from other similar bodies is that they have the power of initiative in the matter of planting; they decide that a certain street is to be planted and determine on the species of tree. An advertisement of the intention to plant is inserted for two weeks in any public newspapers and all persons interested in the improvement are given an opportunity to be heard. After the work is done the Commissioners meet and certify a list to the Receiver of Taxes, on which are given the names of the owners in front of whose property trees were set out and the cost of the work. These assessments are entered by the Receiver of Taxes on the annual tax bill and are paid the same as any other legal lien. The cost of pruning, spraying, removing dead trees and repairing old ones is provided for by a general appropriation.

Amendments of the years of 1905 and 1906 to the New Jersey act of 1893, gives the Shade Tree Commissions the power to pass, enact, alter and amend, and repeal ordinances relating to the planting, protection, regulation and control of shade trees and to prescribe fines and penalties for the violation thereof. These amendments also provide that the parks in cities having Shade Tree Commissions shall be placed under their control. These provisions are also embodied in the Penn-

sylvania act of 1907. The Shade Tree Commissions of East Orange and Newark have passed ordinances relating to trees and these are being enforced in the two cities.

It becomes apparent to anyone who is engaged in tree work for even a short time that there exists an intense love for trees in every man, woman and child. That love, however, is not always accompanied by a knowledge of what species of trees are best suited for planting, how to plant these trees and how to care for them. A review of the work done in cities of the State of New Jersey will show that no such good results could possibly have been accomplished by individual planting and care of trees. In our State the cities where the best results have been attained since their trees have been placed in the hands of Commissions are East Orange and Newark. I shall draw for my illustration of the practical results of the municipal control of shade trees from the work which we have been doing in East Orange.

The Commission in our city began active work in the spring of 1904. Since that time about 2,700 trees have been planted. The species used were the Norway maple, the sugar maple, the red maple, the European linden, the American linden, the pin oak, the red oak, the Oriental plane, the gingko and the ash. Only one species of tree was planted on a street. These were set at uniform distances apart, averaging about thirty-eight feet, and all trees were supplied with wire guards. The advantages of such a system of planting can be readily seen. In selecting the proper species of tree for street use, hardy trees are taken, of symmetrical shape, of well-filled head, neither too open nor too compact. By placing the trees at proper distances apart on the street, each tree is allowed to develop its characteristic beauty and when mature there is sufficient space between the outstretching limbs for the admission of light and the free circulation of air. Streets that have become famous for their beautiful shade trees, both in this country and abroad, are planted with one species of tree. This plan is followed in Washington, where some of its most notable streets are East

Capitol street, planted with American elms; Indiana avenue, planted with Oriental planes; Massachusetts avenue, planted with American lindens, and other streets. I have a number of slides made from my own photographs which will help me to illustrate some of the points in the planting and care of trees.

Setting out one species of tree on a street can be done only when one man or one body lays out the street as a unit and selects a tree that is best adapted for the width of the street, the condition of the soil and the nearness of the houses to the street line.. By placing guards around all trees when the are set out, all injury from horse bites is prevented. Such a system has been followed in East Orange, as you will see from the photographs. These streets show in the most characteristic way what can be accomplished by municipal authorities when they have the control of street trees. Both of these streets are such as are typical of any of the recently developed suburban towns. The houses are rather close together, there is not much of a front lawn, but the uniformly planted trees relieve the perspective of the street.

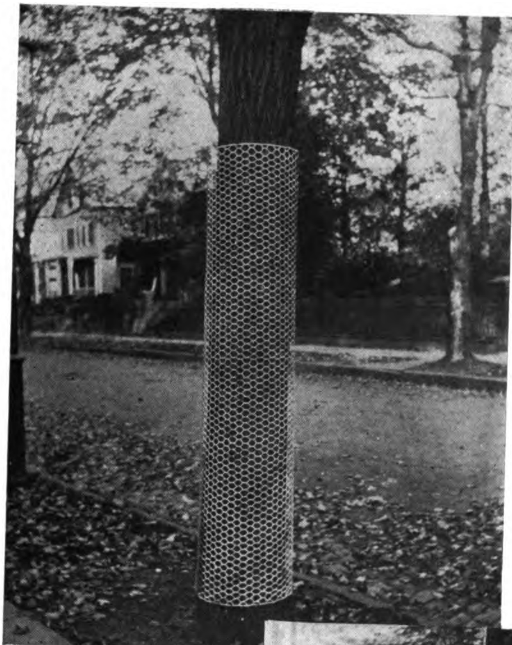
The first cost of planting shade trees is very small compared with the other assessments for street improvements. It costs the abutting property owner on the average about $3.85 per running foot for the macadamizing of a street having a thirty-foot roadway, for the guttering, curbing and laying of a four-foot sidewalk. The distance at which street trees are set is about forty feet. Last year the assessments of the Shade Tree Commission of East Orange for furnishing and properly planting a tree, staking it and supplying it with a wire guard were $3.75 per tree. This makes the tree assessment less than two and a half per cent. of the cost of the improvement of the roadway proper. While the use of the road will cause it to deteriorate and it will need repairs, the trees, when properly cared for, will thrive and grow. Their first cost of setting out will become insignificant compared with their increased value a number of years after planting.

The choice of the proper species of tree becomes an important factor in contributing to the beauty of the street. Ordinarily when a man goes to a nursery to buy a tree he says: "I want a tree that will grow rapidly and give immediate shade." The result is that the nurseryman will give him a Carolina poplar or white maple, which are the most undesirable trees for street use. Their planting is usually prohibited in cities having Shade Tree Commissions. The Carolina poplar grows very rapidly, in fact, in a short time it becomes too large for the average street. As a result it is repeatedly cut back in order to force it to assume a medium sized head. The planter tries to counteract, shortly after planting, the very characteristic which recommended its first choice as a shade tree. The result is an abnormal tree with a thick trunk and a small head. When this pruning continues with a great degree of severity the poplar becomes ugly and repulsive. The roots of the poplar are also an undesirable feature, for the fine rootlets fill up sewer pipes and stop the flow of water and the larger roots lift up flags and put the curbing out of line.

In the matter of the choice of trees there is a popular notion that oaks grow slowly and for that reason these trees are not planted. People will say that it takes a lifetime for an oak tree to reach any considerable size. Such an idea is easy to overcome by showing what oaks will do when properly planted and cared for. Some of the finest streets in the City of Washington are planted with oaks, notably Pennsylvania avenue, planted with pin oaks, and Twelfth street planted with red oaks. In the City of East Orange some streets were planted with pin oaks four years ago and they have grown in many cases even more rapidly than the other species, with the exception of the Oriental plane.

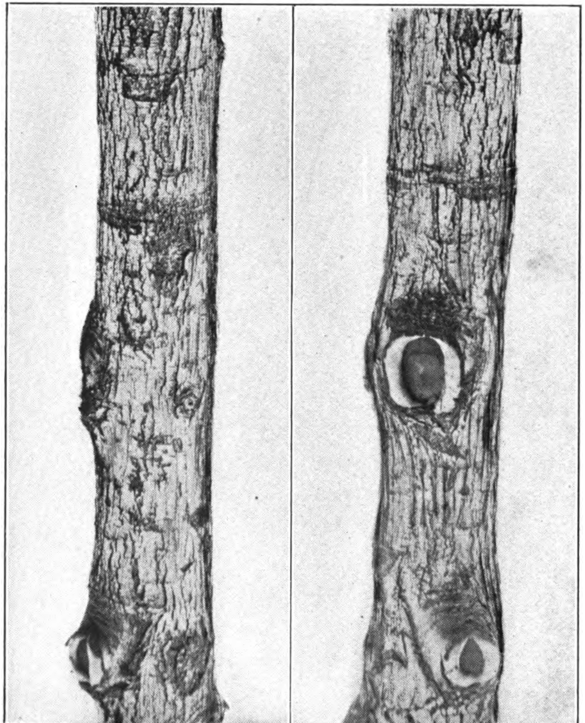
There are about seventy miles of streets in East Orange. The trees on about forty miles of those streets were pruned under the direction of the Shade Tree Commission since its organization. In this work, too, the street was treated as a unit. All trees were pruned to a uniform height, a height that

Midland avenue, showing the result of the uniform pruning of the trees on a street. The photograph was taken in October, 1905, after the sugar maples in the street were trimmed under the direction of the Shade Tree Commission.

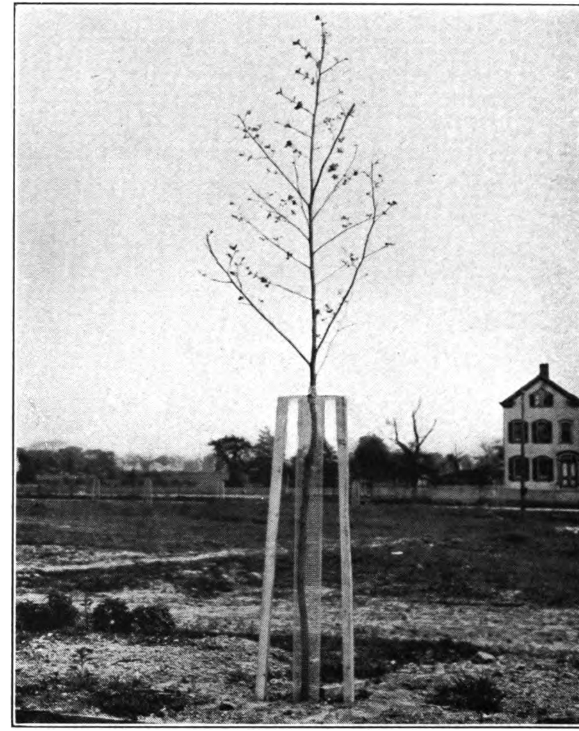


An example of a good, cheap guard for a tree of any size. It is made of hexagonal wire netting.

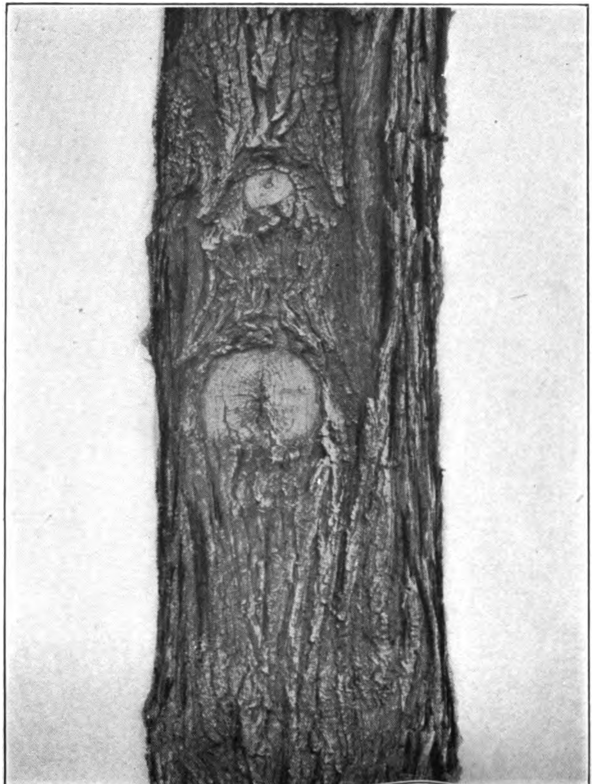
Showing the injury caused by leaving the guard after the tree has become too large for it. If the guard had been very strong the effect of its binding would have been to girdle the tree and it would have died. In this case the guard broke but the tree was disfigured.



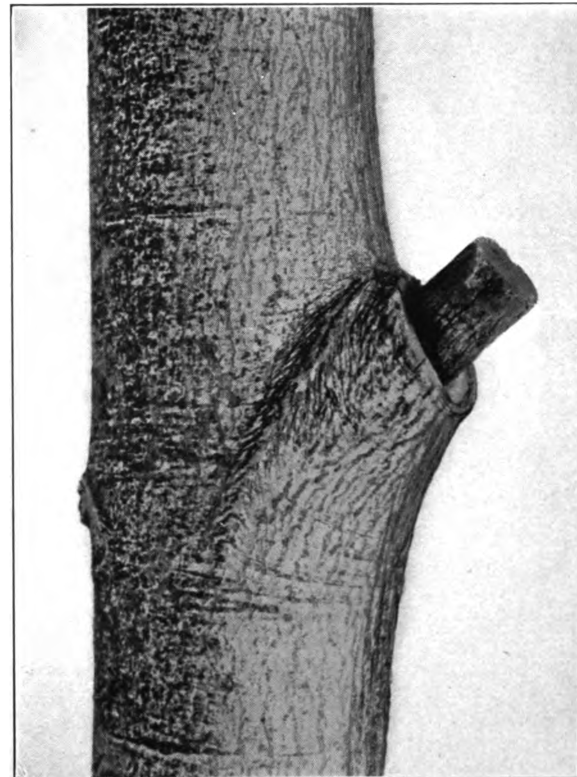
Showing the front and side views of scars on red maples on Girard avenue, pruned by the Shade Tree Commission in 1904. The scars have begun to heal, as will be seen by the formation of callus around the margin of the wound.



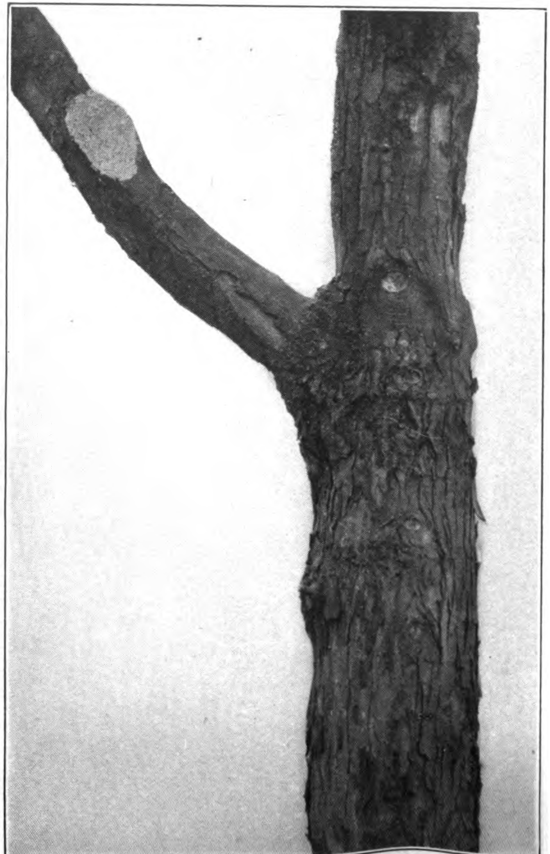
Showing the method of staking the newly planted trees, and wire guard.



Showing pruning scars on the trunk of a tree that have completely healed.

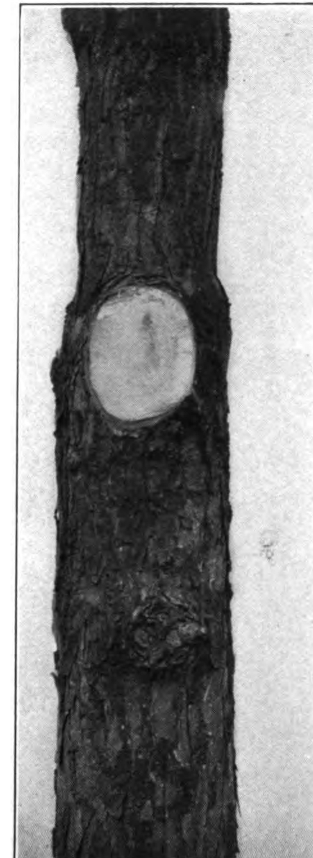


Showing the result of improper pruning or leaving stumps instead of cutting a limb close to the body of the tree. The wound could not heal; the stub rotted, carrying the decay to the heart of the tree.



Tree with branch to be removed.

Side view of cut.



Front view of scar before being painted with coal tar.

Showing how a limb is cut close to the trunk

would permit the unimpeded passage of vehicles and would allow all street lights to be seen at night. (Slides showing streets with trees pruned and not pruned.)

Few things are more important in the care of trees than proper pruning. The cut should be made close to and even with the trunk. When pruning is properly done the scar will heal. When short stumps are left they dry and rot, prevent the wound from healing and carry decay into the tree. (Slides showing proper and improper ways of pruning and how the wounds heal.)

A matter that is neglected when trees are left to the individual to look after is the placing of guards around them. Of all mechanical injuries to shade trees those by horses are most fatal. On any street having trees may be found scores of examples of trees which have been barked by horses. The annual layers of wood fail to cover up the portion where the bark had been stripped. The exposed wood dries, checks, moisture causes it to rot and the decay is soon carried to the heart of the tree. Newly planted trees in East Orange are provided with uniform wire guards and the trees are staked to keep them upright until the roots take firm hold of the ground.

The preservation of existing old trees is even of greater importance than setting out new ones. The lack of care of trees in the matter of placing guards around them, the leaving of short stumps in pruning and other neglects cause mutilations of the trunk and stems of trees that need attention. Tree surgery, therefore, forms one of the important divisions of the care of trees. Cavities in trees, no matter how caused, are thoroughly cleaned of all decayed wood, painted with tar and filled with cement. It is a process very much similar to that of filling a tooth. Small cavities are filled with the usual cement mixture of one part of Portland cement to two parts of sand. In the case of larger cavities, bricks and stones are used to retain the concrete, and the result is that a strong masonry column is erected within the hollow tree and is thus strengthened. The filling follows the contour of the tree; but the cement is not

filled flush with the outside bark of the tree, but is filled up to the line separating the bark from the first layer of wood, so that the new growth of wood will form a callous around the border of the filled cavity and in time the bark will roll over the cement and cover it entirely, leaving no trace of the cement exposed.

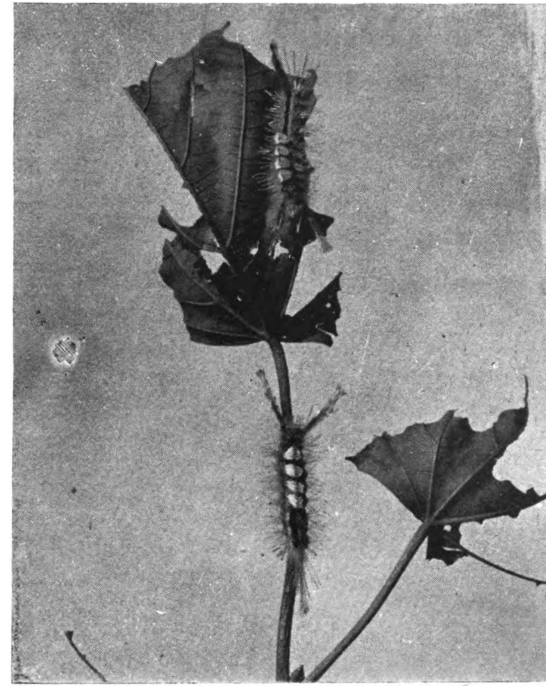
The most important work by far in the care of trees is the extermination of the insect pests that annually threaten to injure and destroy our trees. From the time the leaves put forth their foliage in the spring until the fall there is the cry from all parts of the country: "Can't something be done to save our trees?" The annual destruction of trees by insects is enormous. If they are not entirely killed they are defoliated by caterpillars and lose their usefulness for a season. During the four years that the Shade Tree Commission of East Orange has been organized the following pests have been successfully controlled. The Tussock Moth, attacking the American elm, the American linden, the white maple and the horse-chestnut; the Cottony Maple Scale, attacking the white maple; the Woolly Maple Scale attacking the sugar maple, and other insects. As far as possible, the idea borne in mind was to fight the insects before they developed, and hence before great damage was done. The Shade Tree Commission has a power sprayer, by means of which the tallest tree can be sprayed.

Just as it is the desire of every man to make his home beautiful, so it is the desire of every community to make its city beautiful. For what is the city but the cumulative home of its inhabitants? All over the country we find evidences of the earnest effort to make the city not only the site of manufacture and commerce, but the place where one would enjoy to live.

Few things contribute more to the cultivation of local pride and civic patriotism than beautiful trees in the parks and on the streets. The importance of the task of planting and caring for trees is as great as the execution of any other city improvement. It is felt that such work cannot be carried out success-

A twig of the American Elm showing the damage done by the caterpillars and the adult of the Elm Leaf Beetle. The caterpillars eat only the under side of the leaf causing it to become skeletonized, to turn brown in color and to curl up. The adult beetle eats through the leaf making it full of holes.

The Pseudococcus aceris on the under side of a sugar maple leaf, photographed July 17, 1906. This shows the mature female insects surrounded by cottony tufts containing eggs from which the larvae hatch. These, as will be seen, lodge themselves along the veins and suck the sap of the leaves, thus causing them to fall from the trees in great numbers.



Caterpillars of the Tussock Moth feeding on leaves of the American linden. The caterpillar stage is the feeding time in the life history of an insect, and when the caterpillars are numerous entire trees are sometimes defoliated. The Tussock Moth infests the elms, the American and European linden, the horsechestnut and the white maple.

Cavity of the tree.

Cavity after it has been thoroughly scraped and all decayed wood removed, preparatory to filling.

Tree after the cavity has been filled with cement.

Showing the process of cementing large trees that have been injured by horses, etc.

fully by the individual. The best results can be obtained only by a municipal body vested with the proper authority to make improvements and carry out the work under expert supervision.

DISCUSSION.

MR. BARROW: I would like to ask whether the ordinary pavements of streets injuriously affect the growth of trees?

MR. SOLOTAROFF: No, sir, we do not find it so. Of course the life of a tree in a city is rather a hard one, and we do find that the pavement does not supply the proper moisture as out in the woods and lawns, but we find that the trees do very well in our city. When the trees are set out new soil is generally put in, and then in following years we use either chemical fertilizers or manure to enrich the soil, and keep it loose and free from weeds, and in that way the trees do very well in our city.

MR. RUST: You speak of the roots of the poplar tree choking up the sewers and drains. Have you found that any particular tree or trees have a tendency to move the sidewalk?

MR. SOLOTAROFF: Yes, sir, the Carolina poplar does that. The roots become so thick that they crack the concrete walks. If they are flag walks, they are raised, but if they are concrete walks, they are cracked; and they also push the curbing out of line. They grow so phenomenally rapidly that they do that injury to the sidewalk.

MR. RUST: Does any other tree besides the poplar do that?

MR. SOLOTAROFF: The elm does that likewise sometimes, but other trees do not do it to the same extent.

MR. ANDREWS: I would like to call attention to the fact that in the State of New York, the City of Buffalo has lately, by charter amendment, provided for a forester for the care of trees, and cities of the second class in the State of New York have a provision that the Commissioner of Public Works may appoint a supervisor, who shall have supervision of the maintenance, care and control of the shade trees in the city. In the city from which I come it is practically a dead letter, except that the city does spray the trees after a fashion. It comes too late, as a rule, however, to do any good. The poplar for many years has been known in my city as the cotton tree, and in the spring, as the author has stated, the cotton blows around the trees and into the windows and gets into the furniture, and long ago the tree was condemned by the Board of Health as a public nuisance, and all of the trees ordered cut down in the city. Most of them have been. That is one very great objection to that poplar tree.

MR. WARREN: It occurs to me to suggest in answer to the question regarding the effect of pavements on shade trees to refer to the fact that

the City of Washington, as the lecturer has stated, is one of the oldest cities which has systematically cared for its shade trees, and also is one of the oldest cities in this country which has laid waterproof pavements and nearly waterproof sidewalks for the longest time. Pennsylvania avenue was one of the first streets in this country paved with asphalt, and I notice it is one of the streets illustrated here as having the finest shade trees.

I want to ask Mr. Solotaroff if they have been troubled in New Jersey with the gypsy moth and browntail moth, which is a serious pest in Massachusetts and all through New England, and which has cost millions and millions of dollars, and yet we make no headway against them.

MR. SOLOTAROFF: We have been very fortunate not to have the gypsy or browntail moth in New Jersey. In fact, it has been a debatable question how far the climate of New Jersey would be favorable to that moth; of course no one has brought any insects in and tried it, but it is thought by the entomologists of New Jersey that the climate would not be favorable to the gypsy moth. The common insects we have had are the tussock moth, which attacks the white maple, American elm, horse-chestnut and American and European linden; the woolly maple scale, which attacks the sugar maple, and the American scale, which has attacked the American maple, but we have not had the gypsy moth.

MR. WARREN: The elm leaf beetle is also an insect which is giving us much trouble in New England, although not as serious as the browntail and gypsy moths, and I want to ask you what you have found out about it? I have had much trouble with the elm beetle and have tried spraying with arsenic salts, but have not been able to make any headway. What have you found was the best method of treating the beetle?

MR. SOLOTAROFF: There is only one effective way of successfully fighting the elm leaf beetle, and when that is done the problem is not a very hard one. I will state briefly the history of the beetle. The adult beetles pass their winter in their hibernating quarters in the attics of barns and houses, etc., and in the spring, as soon as the leaves are formed they leave their winter quarters and feed on the newly developed leaves, eating holes through them. After feeding two or three weeks the female insects deposit their eggs on the under part of the leaf, and from these eggs the caterpillars are hatched, and they then eat the under part of the leaf. The best way, therefore, to fight them is to spray with arsenate of lead as soon as the leaves open up in the spring, and in that way both the adult beetles are caught, and if the spraying is done on the under part of the leaves, the caterpillars also will be caught. It is in a way anticipation of destruction, and when the average man passing by sees you spraying with the leaves beautifully unfolded, he will think you are wasting the city's money, whereas it is necessary if you wish to succeed, because after the caterpillars are partly or half grown, then the arsenical poisoning is not so effective, because the leaves are either entirely destroyed or very nearly. The early spraying is the most effective.

THE ESSEX COUNTY PARK SYSTEM.

By A. M. Reynolds, Jr., Chief Engineer, Essex County Park Commission.

Park development and the benefits to be gained morally, physically and financially from a comprehensive and wisely designed park improvement are so well known and have been so thoroughly discussed that it is unnecessary for me to go into detail, except in so far as the Essex County Park Commission is concerned, and the advantages of a County or Metropolitan system over a municipal system are so great, with its broader views and larger scope, that the State of New Jersey, and Essex County in particular, was, indeed, most fortunate that the minds first conceiving the park idea adopted this view.

In 1894 there was passed by the Legislature of the State of New Jersey a law enabling counties of the first class to establish boards of County Park Commissioners to consider the advisability of laying out ample open spaces for the use of the public. It was empowered to make maps and plans and directed to submit its findings to the Legislature. Immediately after the passage of the act, the Justice of the Supreme Court presiding in the circuit in which Essex County is located, appointed the first, or temporary commission. The commissioners were appointed for two years, to serve without compensation, but were allowed $10,000 with which to conduct their examinations. They reported in eight months and expended less than one-half the amount allowed.

The report of the temporary board showed clearly the need of a comprehensive park improvement in Essex County with its large and rapidly growing population. Following its recommendations a law was enacted in 1895 authorizing counties of the first class to establish boards of Park Commissioners to serve without compensation, with power to acquire land for parks and boulevards and to improve and maintain the same. This is the act under which the Essex County Park Commission was created and is now acting.

Shortly after the appointment and organization of the permanent board the real work of park making was commenced.

Essex County, in 1895, with its population of 300,000 and area of over 100 square miles, had less than thirty acres of usable park land. This was made up of small triangles and squares in Newark, Bloomfield and the Oranges.

One of the first, and perhaps chief principle of park making, is to reclaim and beautify land which, in its present state, is a menace to the health of a community and which from its character makes improvement by individual owners practically impossible. Following out this cardinal principle it has been the aim of the Essex County Park Commission where possible to acquire property of this character instead of securing for park sites land already valuable for building purposes, and which is capable of improvement by private owners.

It can be readily appreciated that this method greatly increases the value of surrounding property. For example, lots bordering on Branch Brook Park, Newark, N. J., have in ten years increased in value, as shown by actual sales, from $500 per lot to $2,000 per lot.

In the selection of park sites the commission has endeavored to locate the parks so as to benefit the entire county. Before any land was acquired a comprehensive scheme was adopted and has since been followed as closely as possible.

The park areas which have been acquired and improved are as follows:

Branch Brook Park, Newark	277	acres
Eastside Park, Newark	12.5	"
Westside Park, Newark	23	"
Orange Park, Orange and East Orange	47.5	"
Watsessing Park, East Orange and Bloomfield	10	"
Montclair Park, Montclair	14.85	"
Weequahic Reservation, Newark	265.08	"
Eagle Rock Reservation, West Orange	413.28	"
South Mountain Reservation, Millburn, South Orange and West Orange	2,500	"

There are also under the control of the board the following parkways:

East Orange Parkway,
Park Avenue,
Prospect Avenue,
Cherry Lane,
Brookside Drive.

In considering a park of considerable dimensions in the City of Newark, the board was largely governed by the fact that the city owned, in what is now Branch Brook Park, about sixty acres of land which had been dedicated for park uses. Taking the land transferred by the city as a nucleus, the boundaries of Branch Brook Park were established and the acquirement of land commenced.

Branch Brook Park lies in the valley between Eighth Avenue on the south and old Bloomfield Road on the north, and, before its improvement, over 200 acres was wet and swampy. As the land was situated in a thickly settled and rapidly growing section, even this did not deter its use for building purposes and tenements of the most rickety kind were scattered over the area wherever enough ashes and garbage had been dumped to secure the unstable foundation with which the residents seemed satisfied. Drainage conditions were unknown and stagnant pools were in almost every dooryard.

After the acquirement of the land, the first work of the commission was the solution of the drainage problem, with the result that the valley for the entire length of the park was thoroughly drained and it was possible to proceed with the building of roads, paths, lawns and other improvements. What were probably the worst portions of the entire tract are now playgrounds.

Following out the fundamental principle of locating parks in territory of little value, a site was selected in Orange for a park of nearly fifty acres, a large portion of which was known as Parrow Brook swamp. Here drainage conditions were similar to those found at Branch Brook park. Although this sec-

tion was only a short distance from the best residential part of the city, few had the temerity to build thereon. The treatment of this area was much the same as at Branch Brook Park. Thorough drainage was first installed, followed by the other construction work necessary in park making.

Eastside and Westside Parks, located in the City of Newark, are other examples of this most important element of park location, and land which had little or no value for residential or commercial purposes was converted into parks and playgrounds.

Another striking illustration of this most important element of park location was the selection of the site which is now Weequahic Reservation in Newark, N. J. Before improvement there was on this tract a swamp of over ninety acres. Over 150,000 cubic yards of bog growth was removed and the unsightly spot converted into a lake of eighty-one acres—one of the finest park lakes in the country. The balance of the swamp land was filled in and planted with trees and shrubbery. Weequahic was primarily intended for a reservation, but its great popularity and the rapid growth of the city have led to its being considered as a park and treated as such.

It may be well to state here the difference between a park and a reservation. Parks are the creation of man, and it is the aim of the parkmaker to reclaim and beautify land which possibly had once been attractive, but whose natural advantages had been destroyed by rapidly advancing urban population. Reservations, on the other hand, seek not to restore, but to preserve natural scenery; their function being to prevent the destruction of landscape beauty and to transmute it into city blocks or factory sites. In other words, to keep intact for the present and for the future some portion of the original wildwood that the past enjoyed.

In considering the park proposition as a whole, the Essex County Park Commission recognized the necessity of locating in the more densely populated centers small areas, commonly known as neighborhood parks, where the residents can find, at

no great distance from their homes, opportunities for proper exercise under suitable supervision. It can readily be appreciated that the number of urban parks cannot remain constant, but must grow and increase in proportion to and in the direction of the growth and increase of the county. This has led the commission during the past year to acquire additional park sites in Newark, Bloomfield and Irvington.

The Essex County Park Commission has given considerable attention for many years to the playground question, and as a consequence, has located in all the parks under its control, athletic fields for the older people and well equipped playgrounds for the children. Field houses with shower baths and locker accommodations are maintained and it is possible for one using the park playgrounds to enjoy all the privileges of a first class club house at no expense. From the fact that the daily attendance at the playgrounds has exceeded 6,000, some idea can be gained as to the popularity of these areas.

While one of the important functions of a well considered park scheme is to improve and beautify land which it acquires, another essential duty is to preserve when possible any natural beauty which still remains. This led the commission to acquire Eagle Rock and South Mountain Reservations. The first is a tract of over 400 acres, located on what is known as the first ridge of the Orange Mountain, about six miles distant from the center of the population of the county. The elevation of the land comprising this reservation is nearly 700 feet above the sea and a fine view of Greater New York and the surrounding country can be obtained from Eagle Rock—the rock from which the reservation derives its name. This tract of land is what the name implies, a reservation preserved for its natural beauty, and nothing in the way of ornate embellishment has been attempted. The woods have been improved by suitable forestry operations, roads have been laid out and one may drive miles in what is almost a wilderness, although only about ten miles from the greatest metropolis in the world.

South Mountain Reservation, located about three miles south of Eagle Rock Reservation, and comprising about 2,500 acres, is conceded to be one of the finest wooded tracts under the control of a County or State Park Commission in the country. This reservation, while also preserving the natural scenery, is of an entirely distinct character from that at Eagle Rock. The reservation includes all of the land from Millburn to the Northfield Road, taking in the valley between the First and Second Mountains and extending from sky line to sky line.

The treatment was similar to that at Eagle Rock. The woods have been improved and drives laid out and at the different viewpoints shelters have been erected where one may gaze at the scenes of man's activity or into the solitude of the mountains.

The commission has been most active in the crusade against the mosquito, with which our section of the State is unfortunately afflicted, and during the past year has expended thousands of dollars in filling and draining breeding places in the reservations. We are now assured by experts in the matter that the park system is free from breeding places of the pest.

The amount expended by Essex County for its 3,500 acres of park land and the improvements is about $5,000,000.

Had each municipality been compelled to acquire and improve its own parks, few of the smaller towns would have been able to possess the privileges they now have, and Newark would not have been able to enjoy the magnificent wooded reservations at Eagle Rock and South Mountain which will increase in value and beauty as years go by.

This is but a sketch of a great metropolitan park system of which the citizens of Essex County are so justly proud. It combines the advantages of the formal park, the playground and the reservation, and gives unusual opportunity for healthful exercise and open air enjoyment. But the parks themselves are their own most eloquent advocates and a visit to them will disclose their beauties and advantages far better than the written line or spoken word.

In connection with Mr. Owen's remark, I might add that the Park Commission has established on South Mountain an enclosure of about 150 acres in which has been placed about thirty fallow deer, and about 300 Hungarian pheasants, and fifty Hungarian hare, the two latter of which we are assured are non-migratory.

DISCUSSION.

MR. RUST: I want to ask Mr. Reynolds how the money was provided to purchase the necessary parks and preserves.

MR. REYNOLDS: The fund was procured by a bond issue on the entire county by an act of the legislature authorizing the county to raise these certain amounts.

MR. RUST: How long do your bonds run?

MR. REYNOLDS: I think for forty years—thirty and forty years. And I might add that before the bonds are issued there is a vote taken for and against the issuing of them. We wish all the voters to have a chance to vote on it.

IMPERIAL ROADS.

By W. B. Spencer, Vice-President Imperial Road Company.

To show exactly what Imperial is and what claims we make for it, it might be advisable to discuss other forms of road building. In so doing, however, we do not wish to decry other methods nor to imply for a moment that we believe they have not their fields of usefulness, but inasmuch as in the perfecting of Imperial the weaknesses of older road building methods were carefully studied, we wish to present these to you in the same way they were considered by us at the time of our investigations.

In the first place, what are the requirements for a modern road, suited to modern conditions? The existence of dust is one of the most important items that are now being considered in connection with roads, not only because of its unhealthfulness, but because it precludes the fulfillment of one of the chief purposes of a road; that is to say, its use and enjoyment as a means of recreation. The presence of mud is analagous to that of dust; where no dust is, mud ceases to be an annoying feature. The question of noise, too, is one that lately has been seriously pondered. The hard road, resounding to the hoof-beats of horses and the rumbling of wheels, is a real and not an imaginary annoyance—although we force ourselves in many instances to become accustomed to it.

These points, although practical, are overshadowed, of course, by the importance of cost and expense of maintenance. Admitting their desirability, we must acknowledge that they have to be relinquished if their acquisition means too great original outlay and a steady drain on the treasury to retain them.

The theory on which roads formerly were built failed to take into account the objectionable features of dust, mud and noise as features which possibly could be eliminated; and roads

were made on the principle of providing a hard, resistless surface which would by its very strength withstand the wear and tear of ordinary traffic. The application of this principle resulted in the construction of roads which for many years served their purpose admirably and which may be, in cities and conjested districts, the best today; but the introduction of the automobile, carrying severe traffic conditions over a larger area than was formerly the case, makes this kind of road possible only where the most expensive methods of construction by this principle may be adopted. With only seven per cent. of the roads in the whole of the United States improved, it is evident that a very expensive method of construction—outside of extreme circumstances—cannot be universally adopted.

Engineers have lately been considering carefully the possibilities of a road constructed on the principle of securing resiliency to such an extent as to distribute over a considerable portion of the surface the weight and wear produced by actual contact with a vehicle, believing that this theory would be productive of more satisfactory results as regards roads than the older methods. That is the principle of Imperial road. Asphalt is of itself resilient. We have found that combined with earth by our process, it loses none of its qualities as a pure product.

To take up former methods of road construction and show how this material was evolved we may consider, first, macadam. Macadam is built, to be sure, entirely of stone, consisting practically of a layer of large stones which serve as a foundation; smaller stones which serve as a cushion, and screenings which serve as a wearing surface. Macadam is weak in two particulars; first, when dry, the surface wears and is taken away in dust; second, when wet, the surface is disturbed by traffic and displacement, thereby causing small depressions to form, allowing water to soak through and undermine the foundation. The surface wear and displacement produces dust and mud. We may say, therefore, that in order to make a perma-

nent and lasting roadbed out of macadam some means must be employed to protect it with a waterproof covering, which in turn protects its foundation and eliminates the dust and mud by preventing water from mixing with it. Finally, we are forced to conclude that the time-honored macadam road is possessed of so many weaknesses, the elimination of which is important to the permanency of a roadbed, that under the existing modern travel it is proving inefficient, and its life is of such short duration that in many instances engineers and road builders are forced to apply one of the many expedients on the market for temporarily binding together the wearing surface before opening the road to public use. This surface application needs frequent renewals at stated intervals, and is a constant maintenance expense to be assessed against the taxpayer year after year. Other methods are in vogue which successfully attempt to strengthen the other inherent weakness of macadam by providing it with a concrete foundation. The only objection to these is that their expense is so great as to prohibit their use in any locality excepting where extraordinary traffic warrants.

The Imperial road is constructed with asphalt and asphalt oils thoroughly and scientifically mixed with the dirt or old macadam ot an existing road, as such material is found. The result of this attempt was to produce not only a new method of construction, but what we consider to be practically a new material.

The characteristics of Imperial—which we claim as its accomplishment—are: (1) That it is waterproof because of the abundance of asphalt in it and thereby protects the foundation, eliminating the weakness of some of the older methods. (2) That it is dustless, although there is dirt in it, the asphalt and asphalt oils are mixed with the dirt to such an extent that they bind the loose particles closely together. (3) It is noiseless; neither dirt nor asphalt possess reverberating qualities. (4) Imperial presents an ideal surface for automobiles or trucking, having a more or less gritty surface which absolutely precludes

LANDING ROAD, LAKE HOPATCONG, N. J.

the possibility of skidding of automobiles and affords horses a firm foothold. These, we claim, are the accomplishments of Imperial. The use of the road for five years in Kansas City, Mo., has, in our estimation, thoroughly substantiated these claims. We shall speak of the results there a little later.

As to how Imperial is built, we can merely say that our method is so simple, at first sight there would seem to be nothing about it requiring an undue amount of experiment and investigation. Its simplicity, however, is one of its most valuable assets, for because of it the original cost of Imperial is low.

In building Imperial roads we use the road dust as it lies after being brought to grade. We first thoroughly pulverize it, and then apply a mixture of asphalt and asphalt oils—the selection and proportions of which are carefully and accurately determined in our laboratories. After the first application the material is repulverized and saturated a second time. The material is then turned over with turning plows, and the process of two applications is repeated. At this stage the material is a soft, more or less spongy mass. While it is in this condition we apply a rolling tamper, which is constructed along quite original lines. This tamper (which weighs three tons) consists of a series of independent teeth, each with a surface of about eight square inches. Of course, in the absence of a plane surface, this tamper—weighing as it does three tons—the first time it is moved over the road sinks for possibly six inches into the mixture of dirt and asphalt. This results in packing firmly for perhaps only a quarter, or half inch in depth, that portion of the material which happens to come beneath any of the teeth on the solid base below, leaving the rest in its original conditions. This roller is hauled back and forth over the road until it has so thoroughly tamped the loose material that it rises to the top of it and leaves only small indentations on the road. This procedure is one of the strongest features of the process. It means the tamping *from the bottom up* of what becomes finally five or six inches of compact matter. We are frank in saying that we believe that unless

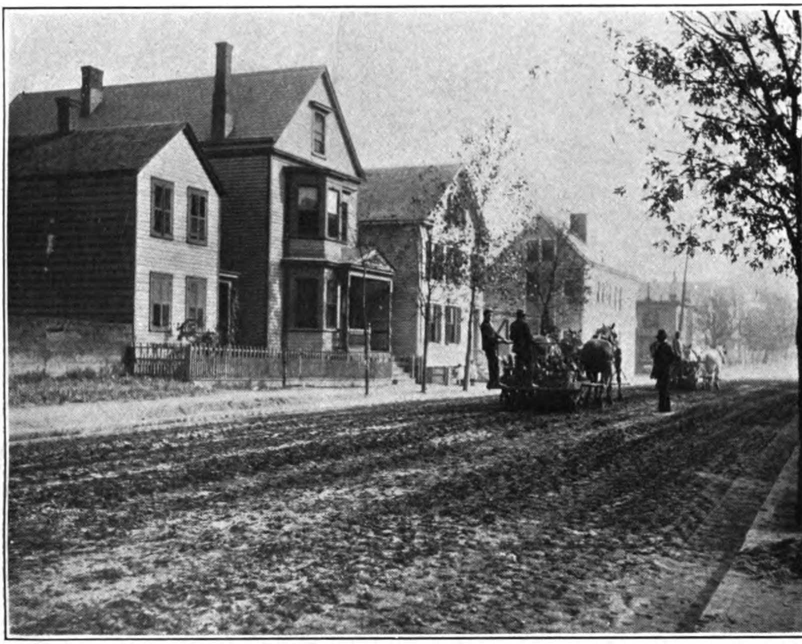
this were done the road would not be successfully constructed, and we are sincere in saying that tamped in this manner it is the best and most logically constructed form of roadway that has yet been attempted.

After the tamper has served its usefulness the road is brought to a permanent and smooth surface by means of an ordinary steam roller, followed by a thin application of sand or gravel and a small quantity of hot asphalt.

The result is that a road so constructed lasts. It lasts because, being waterproof, it preserves its foundation, because the material, being resilient, distributes over a comparatively large area any extreme weight to which it is subjected; because the surface—and, in fact, the whole material—is plastic and adhesive to such degree that an indentation made by a horse's hoof or a scar made by a wheel will be smoothed out and repaired by the action of subsequent traffic—the very feature which was the greatest destroyer of the old macadam method.

We did not know when Imperial was first thought of that a practically self-healing road would ensue. We did believe that we could produce a waterproof, dustless, noiseless material; but experience has proven through the hard usage to which our road has been subjected for five years in Kansas City that it is indeed self-healing. In that city the road we speak of, which is five years old, is in better condition today than it was when it was first laid. It has not rutted, even to a slight degree, nor are there depressions in it. This fact is the more remarkable, and proves most conclusively that the road has self-healing qualities, when it is considered that during the five years not one cent has been spent in maintaining the road.

Another asset Imperial possesses, which has been illustrated in the foregoing instance, is the economy which Imperial provides in the laying of sewers or mains in a road so constructed. Imperial can be taken up very easily, and, separating, as it does from the earth below it, can be thrown to one side. After the pipes and mains are laid and the trench refilled and tamped so as to give an even foundation, our material can



TAMPING IMPERIAL ROAD, HARRISON, N. J.

be replaced in any manner; that is to say, upside down, sideways, or with the former surface uppermost. Imperial being the same all the way through, it is not necessary (as is the case with other methods) to fill in an excavated portion of the road with layers of different composition.

If the simplicity in method of construction of Imperial does not appeal to one immediately as a feature possessing desirability, it will do so as a means of determining the cost of the road. We can build Imperial, generally speaking, for the same price at which Telford macadam with a dustproof surface can be constructed; and we do not hesitate to affirm that the maintenance of Imperial will cost little or nothing.

EQUIPMENT USED TO BUILD IMPERIAL ROADS.

The equipment used in building the Imperial roads is well worthy of description because of its ingenious labor- and time-saving machinery by means of which large contracts may be handled and the most satisfactory results obtained in an increditably short time by the employment of a comparatively small number of men. Each road-building outfit is composed of a huge heater for heating and mixing the binder; two rolling tampers weighing respectively 8,000 and 5,000 pounds each; at least two sprinkling wagons equipped with compressed air tanks; at least two supply wagons with compressed air attachments; a road grader for crowning and surfacing the road capable of doing the work of a hundred or more men; numerous rooting and turning ploughs; spring tooth and disk harrows for thoroughly pulverizing the roadway and mixing the binder with it after ploughing; one ten-ton three-wheel and one five-ton tandem steam road-roller for ironing out the surface after the tampers have turned the road into one compact and monolithic mass. A mounted tool box brings up the rear of this unique highway train, which is made so as to be coupled together and is very easily hauled by the road rollers.

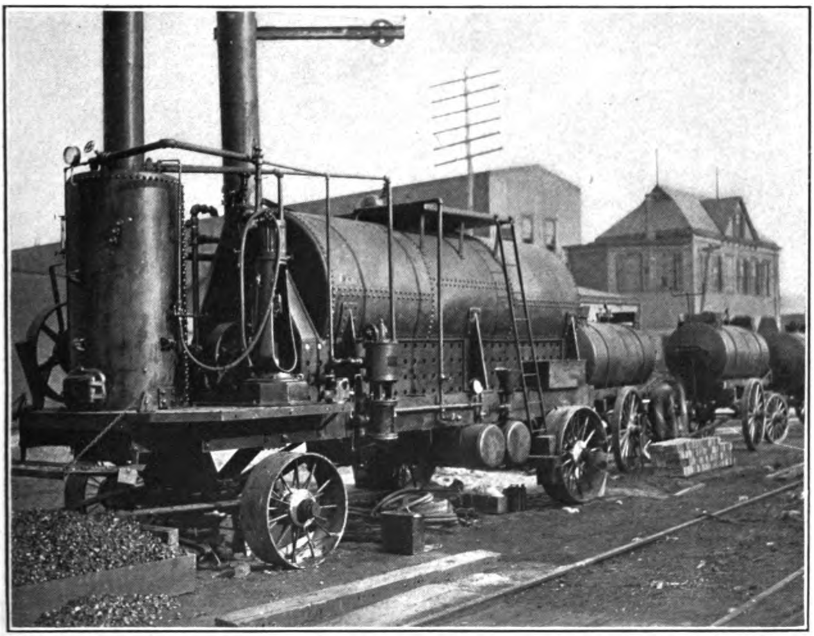
The heater is the largest and heaviest part of the equipment, weighing about fourteen tons. It comprises a steel tank

5½ feet in diameter by 15 feet long, for heating and mixing the asphaltic binder; a vertical boiler; air compressor; rotary pump hoisting engine and small derrick, all arranged in the most compact manner and securely fastened to a frame of 12-inch channels, which in turn is mounted on steel wheels having tires 12 inches wide.

The boiler is used for forcing steam through the pipes in the tank cars in order to flux the heavy asphalt oil before pumping it into the heating tank; also for running the pump, air compressor and hoisting engine. The solid part of the binder, in the shape of 500-pound drums of pure asphalt, is picked up and hoisted to a steel platform on top of the heating tank, where they are broken up and thrown into the tank in proper proportions with the asphalt oil; where the mixture is raised to a temperature of 350°F. The heating is accomplished very quickly by means of a special oil-burning arrangement in which the oil is supplied to the fire box in an atomized spray by compressed air, thus giving an intense heat and complete combustion, thereby eliminating all nuisance due to fumes and smoke.

The pump is again used to transfer the heated binder from the heating tank to the sprinkling carts, which are supplied with compressed air at the same time from the compressor.

The oil sprinkling carts have a cylindrical steel tank 3′ 6″ in diameter by 9′ 9″ long, which is divided in two compartments, the forward one for compressed air and the rear for the heated binder. This sprinkling wagon is drawn over the prepared roadway, and the binder at 350°F. is forced vertically downward by an air pressure of 40 pounds to the square inch, through a perforated pipe running across the rear of the cart. After the roadway has received the proper quantity of binder and been suitably worked with the harrows and turning plows it is roughly surfaced and crowned with the road grader preparatory to tamping.



ASPHALT HEATING PLANT, IMPERIAL ROAD CO.

DISCUSSION.

Mr. Howard: I have seen in California a great many miles, and had reports checked up of two thousand and some odd miles, of roads impregnated with California oils of various kinds. Of course this method in general, with the volcanic dust of California, its enormous counties and dry climate, is of great benefit there. These roads are very soft and very oily, and a great majority of them would not be tolerated in the central part of the United States or the East. On those roads I saw quite a number of miles of what we students of streets and roads know is there called petrolithic, which means a system of putting oil on the earth in a road and churning it and tamping it with the petrolithic roller, which is a roller with spikes and hooks on it. Is the roller you use the same as the petrolithic roller?

Mr. Spencer: No, the construction is entirely different. The petrolithic roller is built of a solid drum, which has a series of hooks on it. Our roller is built of a series of ten cast iron discs which revolve around a common axle, each disc revolving entirely separate from any other one and revolving at any rate of speed that the ground may need. Between each two consecutive discs there is a cleaning bar, and if any of the asphalt is taken up, this bar wipes it off and puts it back. The teeth also are different in shape. The tooth on our roller is about the same width all the way down and it is of a different shape.

Mr. Howard: Then both of them are practically rolling harrows which penetrate the mass or surface of the road and press it out at the same time. On general principles, is that correct?

Mr. Spencer: Yes, sir.

Mr. Howard: Your roller is patented and their roller is patented?

Mr. Spencer: Our roller is patented, and I think theirs is.

Mr. Howard: In the construction of this road, what are the essential principles that are patented? That would show the new and novel features in your art.

Mr. Spencer: I really can't repeat the exact wording of the patent. The principle involved in the road construction is a waterproof binder in the road.

Mr. Howard: This is not an outcome in any sense of the petrolithic system of California?

Mr. Spencer: Not at all. It is altogether different, and it was devised at an entirely different time.

Mr. Howard: My other question was in regard to the asphalt which you use, the asphaltic oils. Do you use the selected crude asphaltic oils; that is, of asphaltic base?

Mr. Spencer: Entirely. We use no paraffine.

Mr. Howard: Are they crude or refined?

Mr. Spencer: We use the refined oils.

Mr. Howard: Similar to the Kansas oils, or Territory oils?

Mr. Spencer: Yes.

Mr. Howard: Not the paraffine base oils of Ohio and Pennsylvania?

Mr. Spencer: No, we don't use any paraffine oil at all. I might say that some of our material we bring from California.

Mr. Kingsley: I would like to ask Mr. Spencer another question. Your closing statement was to the effect that your street, prepared as it was, would probably outlast a treated macadam road perhaps two years. Is that right?

Mr. Spencer: That is what we figure on.

Mr. Kingsley: Your paper was very interesting to me all through, but I could not see any facts in your paper that would bear out that statement, and I would like to have you explain in what way you arrive at your reasoning; in what way a soft basic material—of course the earth is the basic material; your asphalt is simply the binder—would bring that result? In a macadam road, and especially in our roads around Little Rock, where we have the best trap rock in the country, equal to a good deal of the rock here in New Jersey, I can't understand why, with a trap rock base and the same binding material, or even bithulithic binding material, or any good binding material, why a better street could not be secured, more permanent and more stable, than by using soft earth as the basic material.

Mr. Spencer: I speak especially of the macadam. I don't know how it is in your country, but I understand that the macadam roads on Long Island, for instance, and in parts of New York City, hardly last a year without the necessity of repairs. Perhaps you do not get as much traffic there, and especially automobile traffic, as in the east. I refer especially to one road in Kansas City that has been built five years and subjected to heavy traffic. There is a stone quarry on one end of that street and they are hauling stone on that street nearly all the year. They were hauling it when I was out there in big, heavy trucks with narrow tires. It was built of the adobe clay that they have in Kansas City, and it hasn't had any repairs for five years.

Mr. Howard: This Imperial road construction is really intended for roads in the suburbs of cities and between cities rather than city pavements in cities, is it not? Long stretches in the country where the macadam would be too expensive to maintain and you want something for country travel?

Mr. Spencer: Exactly. We haven't subjected it to the very heavy trucking in the center of cities. In this road in Kansas City it has been subjected to very heavy trucking, but we do not know what it would do on Broadway in New York City.

Mr. Blair: What road is that in Kansas City?

Mr. Spencer: It is West Prospect.

The President: I believe Mr. Owen has been watching this matter, and perhaps he can give us some information on the subject.

Mr. Owen: I have been watching a stretch of this pavement, but I haven't had an opportunity to see it since it was finished, so I cannot speak of the finality of this construction. The only point I wish to emphasize on this question of pavements is that the day of hard roads and hard permanent surfaces for through travel is, I think, gone. The present mode of travel on highways has developed a new character of wear, and the present construction of highways is not able to stand it. The demand is for a resilient pavement, a pavement that will be elastic and that incidentally will not wear to the extent that the ordinary hard road wears. The resilient pavements now in the market show little wear from the average travel that goes on them. I, of course, do not allude to very heavy teaming in the cities; but the trend of development of highway construction in the future will be on the lines of this elastic surface. Whether the Imperial is going to fill the bill, or whether some other mode or method will be devised superior to it, I cannot say. I understand there is a pavement now of similar character on a road in the northern part of this state, and I am going to view that soon. In Philadelphia they are constructing pavement of similar character, not using crude dirt, but using gravel, and that is giving good results. I do not understand Imperial confines itself to the crude material that may be on the site of the street, but I do think that in time you may find that properly selected material, adjacent, not carried from a distance, can be used on most of our highways. We have been careful in selecting roadway material to get the best, even though we have had to haul it from ten to one hundred miles. Now, if inferior material can be found with less hauling and less cost of quarrying, my idea is that this softer material may be made as available as the old, hard, indurated rock.

Mr. McClure: I was very much interested in the discussion of the Imperial roads. As a matter of fact, upon the receipt of the program which the Secretary sent me some time ago, I was interested to know what Imperial roads might be; and in listening to the paper I was struck with the wonderful similarity to the petrolithic, as I presume Mr. Howard was, judging from his remarks. I have been familiar with the building of the roads in California for five or six years. Monrovia, I presume, has thirty miles of roads built by what is called the petrolithic method; some of the finest roads I have ever seen. As a matter of fact, when I first visited

them I could scarcely be convinced there was not an asphalt sheet covering over a more solid surface. Since that time I have visited Los Angeles and seen the same treatment on one of the finest streets in Los Angeles; and a short time ago I had the privilege of riding on the Pasadena-Los Angeles boulevard constructed of the same material and in the same way at a cost of less than four cents a square foot—marvelous results to me for so small an amount of money. In examining these different roads at different times I became somewhat intimate with the sellers of the Fitzgerald roller, and upon my own request they gave me some of their photographs of the test made concerning the dust on this boulevard. These photographs are here and you are all welcome to look at them. I have no interest whatever in the scheme and it was purely out of the love for good roads that I brought them here.

MR. HOWARD: I would like to state that in examining many roads in California stuck down with California oils I found them to be of very light traffic as compared with eastern traffic; and under those conditions of light traffic, and for the suppression of dust, an elastic road is highly successful.

THE PROPER CONSTRUCTION OF BRICK STREET PAVEMENTS.

By Will P. Blair, Secretary, National Paving Brick Manufacturers' Association.

The use of vitrified brick or block for streets and roadways is an American idea which originated about thirty years ago. It was developed from the use of brick made from the ordinary surface clays for such purposes in a few of the smaller cities of Indiana and Illinois. Shortly afterwards, brick made from fire clay in the upper Ohio valley were used for a like purpose.

It will probably never be established as to who made the first vitrified brick from shale in this country. One thing is certain, that the first stiff mud brick made from a mixture of shale and common clay were produced in central Illinois. The use of these for street paving purposes naturally followed the use of the common brick, and thus, more by accident than design, such brick were found to resist the wear of travel with greater success than the brick made from the surface clays, and the value of vitrified brick for paving purposes was established.

In like manner it may truthfully be said that for many years following the earlier manufacture and use of paving brick, progress toward betterment was to a very great extent merely incidental. The extension of use for street paving purposes was slow. Few of the earlier manufacturers, if any, realized the development about to take place, and very few of the manufacturers had any concern about the relation such uses bore to the importance of the business.

The demands for the product, however, grew continuously, regardless of the fact that so few were giving any attention whatever to their proper use as a street paving material. Finally some few of the manufacturers began to realize that the lack of appreciation of brick streets was due to the fact that

they were almost universally built without consideration either as to the physical advantages insuring durability, or in a manner making possible the greatest satisfaction to the user. The few, however, whose eyes were opened to the facts began a careful study and inquiry into the methods of construction promising to afford the greatest satisfaction possible from every standpoint.

A few engineers in the central west early realized the importance of proper construction and appreciated more than the manufacturers what the future had in store for vitrified brick. These engineers and these manufacturers, while still maintaining the value of the use of a good quality of vitrified brick for street construction, were convinced of the utter folly of depending upon that alone, and saw that other elements were equally necessary. It is not too much to say that even now the brick are too often required to bear the burden for a satisfactory street. Neither is it putting it too strong to say that the criticisms offered against brick streets are due in nine cases out of ten to other causes than the quality of the brick.

In the month of July of this year, we had the opportunity of examining the brick streets in more than fifty cities east of the Allegheny mountains. We were greatly surprised that in but three cities did we find the essential details of brick street construction at all complied with. Many of the details of a properly constructed brick street seem not to have been considered by those who are charged with their construction, as being in the least degree important; they are, nevertheless, absolutely necessary for the construction of high class brick pavements.

It is therefore the purpose of this paper to point out the essentials which are often overlooked, ignored, or in some way or on some account neglected, rather than to follow out all of the directions necessary from foundation to finish.

I wish, however, to emphasize one thing—that while a compliance with the details of construction that may be here suggested is vital in their importance to the value of the street,

nevertheless not a single suggestion here made is difficult in the least degree, neither adds greatly to the cost. If neither difficult nor costly, why are they not complied with? Practically all of these requirements are suggested in the "Directions for Laying Brick Street Pavements," which are promulgated by the National Paving Brick Manufacturers' Association. These directions, or specifications, have been adopted by practically all of the progressive engineers of this country. We wish, therefore, to give a brief answer to this question later on in this paper.

The preparation of the subgrade for brick streets does not differ essentially from that necessary in case of streets constructed with other materials. It must be drained, graded, compacted, and established in conformity with the grade of the finished street. This must be accepted as necessary by everyone. A depression here and there in the grade, a spot of loose earth, a lack of thorough compaction, or a wet soil improperly drained, must, without question, be followed by conditions of the street that will bring disaster to the street as a whole.

FOUNDATION.

As to the quantities of the mixture that enters into the concrete foundation, so much depends on the quality of the cement to be used, the quality of the sand, gravel, stone, etc., that we will not undertake to say what proportion of cement, sand, broken stone, or gravel shall be used. Suffice it to say that the quantities must be such as will make absolutely sure the quality. There are, however, some fixed and well known conditions in the preparation of the mixture of the concrete foundation, that in order to insure the quality of the concrete, must be observed whether or not the concrete be machine or hand mixed. In order that it shall have its maximum strength, it must be mixed dry in the first instance and then thoroughly mixed after the water is applied.

Either in the machine or hand mixing an intelligent supervision is worth while at all times. I have observed very often

the value of the concrete reduced at least fifty per cent. by carelessness, by ignorance or indifference, by the application of too much water, or by the application of too little water, by the lack of a proper proportion of some one or another of the other ingredients composing the foundation, resulting in a square yard, two square yards, or three square yards of the concrete foundation being of no more value to the street itself than a loose pile of broken stone or gravel. This manner of making the concrete foundation absolutely insures its failure; such concrete being so mixed that if it were in a building, the building would fall of its own weight, as has happened in many instances. Such conditions obtaining in a street, while not insuring a fall, do insure a failure.

This concrete, as it is put in place, must have a surface uniform with the grade of the finished street. Just at this point are frequently found conditions which insure the failure of the street. We have said it must have a grade uniform with the grade of the finished street. The surface of it must be smooth. This cannot be accomplished by depending upon the eye; the grade stakes should be set at no greater distances apart than four to five feet. If any stone used in the concrete exceeds in size two inches in its largest dimension, it will be next to impossible to accomplish the condition desired. Sufficient water should be used in the mixture so that one man can smooth the top with an ordinary dirt shovel—never should it be so stiff as to call into use a rammer.

It has been an interesting study from the viewpoint of both the engineers' and contractors' experience in this matter as to what a uniform and smooth surface means when applied to a concrete foundation. With some, a range of grade from two to three inches furnishes a fine job. We wish to emphasize that a greater variation than one inch is utterly inexcusable in the matter of a concrete foundation for brick streets.

SAND CUSHION AND EXPANSION JOINTS.

The sand cushion must be two inches in thickness; if less than two inches, it will not afford a sufficient relief from the

vibration created by the impact of travel. If more than two inches, it cannot be sufficiently compacted to afford a support to the load coming upon the brick street, and prevent cracking and crushing of the joints of the cement filler which is required in finishing the street. Thus, this cushion must be of such a thickness as will afford a relief from the impact and weight, slight though it be, yet sufficiently unyielding to furnish the support for the load it must bear. But why do we lay down the hard and fast rule of two inches as meeting these physical conditions? The best answer that we can make to such a question is not theoretical, but an absolute fact, thoroughly demonstrated, that under such other conditions here required, neither bond nor brick has ever broken in any place under any condition of traffic in this country. The best brick made is easily broken by a blow much less in force than that made by a 1,000-pound horse, if such brick rest directly upon any rigid surface, and no reason exists why such brick will not be broken by the 1,000-pound horse, if thus exposed, uncushioned and rigid.

With the sand cushion properly spread upon the concrete foundation, the next thing to be considered is the provision for expansion. This must be provided for by placing next to the curb a board of sufficient width to extend above the height of the brick, which is generally four inches. In order that it may be readily drawn, it is advisable that a wedge be dropped at intervals of three to four feet behind this board and extending above it from three to four inches. The wedges should be one-half inch in thickness at the top. The thickness of this board should vary according to the width of the street, ranging from one inch to one and one-half inches; always favoring the safe side by providing sufficient thickness.

Need I expressly urge this provision? It will eliminate the longitudinal cracks, preserve the curb, and prevent the pinching from which much chipping and crushing of the brick result, as well as permitting the brick to lie thoroughly impacted into the sand cushion underneath them, so doing away with the ex-

cessive noise which brick streets are reputed to possess, but of which they are innocent when combined with proper elements of construction. In other words, let the brick street lie with its own dead weight upon the sand cushion, and it will neither rise up nor make a noise.

LAYING THE BRICK.

Next in order is the laying of brick in the street. Much money is often wasted to the contractor, and in some cases to the brick men, by practices that are wholly bad from an economical point of view, as well as lacking in methods assuring the best results. It is necessary that the brick be placed in the street with the best edge up. This is a rule universally required of brick construction in masonry work. In order that this shall be done, the brick should be delivered to the person who drops them into the street with the face placed to suit the hand operation of such person, who may be called the bricklayer. This is best done by the man either bringing them in by board or by the use of a gravity carrier. The edge of the brick that is most subjected to the action of the flame and the chemical influence wrought in the burning, the chipped corner, the warped edge and extreme kiln mark should go down and not up. Any intelligent person can soon train a whole gang of workmen as to which the face edge of a brick should be. It is determined by several little factors as easily contra-distinguished as the countenance of one man is from another.

The wheeling of brick over those already laid;

The dumping of brick;

Depending on a process of turning over those not faced, ought never to be tolerated.

The brick should not be placed in the street in close contact one with another. A few days since we saw a man with a forty-pound sledge and a short piece of 2x4 driving the brick as close together as was possibly to do. The specifications for this work provided for the interstices to be filled with sand. It seems to me that the observations of a child would put such methods under serious inquiry.

Such practice will necessarily result in the brick being chipped and the street ruined long before it is possible to fill the interstices with the sand sufficiently for the purpose for which sand is ever put between the brick, whatever that purpose be. I have read specifications requiring the same thing to be done where other provisions of the specifications required a cement filler. With the brick driven so close together, it is impractical, not to say impossible, to put the cement filler in the interstices.

ROLLING.

After the brick are placed in the street it is necessary that they should be inspected before they are rolled, for the reason that as few brick as possible should be disturbed after the rolling. The roller with which this is to be done must be a light one, weighing from four to five tons; one that is easily handled and can move rapidly upon the surface of the brick.

The rolling should proceed from each side along the curb, working toward the center of the street; then cross rolling at angles of 45 degrees; again rolling longitudinally and cross rolling as before, continuing this process until the brick are thoroughly compacted into the sand, so that the grade of the pavement shall be as intended and the inequalities of the cushion ironed out by the sand being pushed up into the interstices of the brick; a condition always found in the case of properly rolled streets by an uneven amount pressed upwards in the interstices running from one-half inch to three-fourths inch, and possibly as much as one inch in depth in some cases.

The rolling is often attempted with either a horse roller or an eight to ten-ton steam roller. With such rollers you cannot roll the street at the angle required and invariably, both with the horse roller and the heavy steam roller, the brick will creep, and as the one edge rises, an excess of sand falls in the space. As the roller comes back in such cases, the brick ride the sand and instead of the pavement becoming smoother and smoother, it becomes rougher the more it is rolled.

In case of an excessive weight coming upon the brick, they will rebound and never can be compacted, and yet both of these bad practices have in many instances been insistently resorted to, to the utter spoiling of the street. But after the brick are properly rolled and compacted, of course, those that have proved bad under the pressure of the roller should be removed and taken from the street. The street should then be swept clean and the brick wet down. However, this wetting down must be done only in one way, and that is by the use of a nozzle either upon a sprinkling can or a hose which will permit but the finest spray of water to come upon the street.

CEMENT FILLER.

In the application of the cement filler, more incorrect and faulty means and methods are resorted to than in any other portion of the work. However, it is true that the proper method is a simple one, easily followed, and absolutely without any hazard to the street.

In order that we may understand why certain directions are insisted upon in the application of the cement filler, we must keep in view the requirement necessary to the greatest strength of the filler, and that is that it must be put in place in the proportion designated in the specifications; that is, one part cement to one part sand in the first course, and two parts cement and one part sand in the last course.

It is as necessary for the sand to be clean and sharp as it is that the Portland cement shall be a good quality. Too much water in the mixture is as harmful as too little. There is only one method—one practical method—that I know of for the application of this cement filler, yet many contractors will resort to other means if allowed, and rebel against the only method which is carefully laid down in the National Association's specifications No. 1, which is as follows:

The sand should be dry. The mixture, not exceeding one-third bushel of the sand, together with a like amount of cenfent, shall be placed in the box and mixed dry, until the mass assumes an even and unbroken shade.

Then water shall be added, forming a liquid mixture of the consistency of thin cream.

From the time the water is applied until the last drop is removed and floated into the joints of the brick pavement, the same must be kept in constant motion.

The mixture shall be removed from the box to the street surface with a scoop shovel, all the while being stirred in the box as the same is being thus emptied. The box for this purpose shall be 3⅓ to 4 feet long, 27 to 30 inches wide and 14 inches deep, resting on legs of different lengths, so that the mixture will readily flow to the lower corner of the box, which should be from 8 to 10 inches above the pavement. This mixture, from the moment it touches the brick, shall be thoroughly swept into the joints.

Two such boxes shall be provided in case the street is twenty feet or less in width; exceeding twenty feet in width, three boxes should be used.

The work of filling should thus be carried forward in line until an advance of fifteen to twenty yards has been made, when the same force and appliances shall be turned back and cover the same space in like manner, except to make the proportions two-thirds Portland cement and one-third sand.

To avoid the possibility of the thickening at any point, there should be a man with a sprinkling can, the head perforated with small holes, sprinkling gently the surface ahead of the sweepers.

Within one-half to three-quarters of an hour after this last coat is applied and the grout between the joints has fully subsided and the initial set is taking place, the whole surface must be slightly sprinkled and all surplus mixture left on the tops of the brick swept into the joints, bringing them up flush and full.

After the joints are thus filled flush with the top of the brick and sufficient time for evaporation has taken place, so that the coating of sand will not absorb any moisture from the cement mixture, one-half inch of sand shall be spread over the whole surface, and in case the work is subjected to a hot summer sun, an occasional sprinkling, sufficient to dampen the sand, should be followed for two or three days.

The first application should be thin in order that it may flow to the depth of the joints of the bricks, thereby insuring a substantial bond, and should be kept in constant motion while being applied, otherwise the sand will settle and you will have water and cement instead of water, sand and cement. The water and cement wouldn't be objectionable, but the sand by itself is wholly so.

It must also be mixed in small quantities, as it is next to impossible to keep the sand in suspension when more than a common water pail of each, sand and cement, is used, and unless it is deposited upon the pavement with the sand in combination with the solution, you will get the cement and water in the lower portion of the joints between the bricks and the sand without the cement in the upper portion. It is preferable, after the sand and cement have been mixed dry, to apply sufficient water and mix

slowly, first to a good mortar, then add sufficient water to bring the mortar to the required consistency. By this method a more thorough adhesion of the cement to the sand can be obtained.

The following practices have come under my observation:

I have seen the filler dipped from the mixing box with a bucket and carried many steps. In such case, the sand was on its way to the bottom of the bucket and the cement was making for the top.

I have seen the mixture placed in a cradle, or rocking box, and in the time intervening, the turning of the box, the sand and cement were undergoing a like separation and as the box was turned, the richer mixture of cement flowed ahead and the weaker and sandy portion remained near the box.

I have seen the water applied before the mixture in a dry state reached an even shade, thus preventing the proper adhesion of the particles.

To remedy the thickening of the mixture, I have seen it entirely ruined by throwing upon the street the water from an open nozzle, which served only to float the cement away from the sand.

I have seen the mixture put upon the street much faster than it could be swept in.

I have seen the mixture prepared in a dry state in large quantities at intervals of a few feet upon the brick and the water applied and the sweeping-in process undertaken simultaneously.

I have seen the mixture made up in such large batches that it required a sweeping of several feet before it could be made to disappear in the interstices. In such cases, the last that went in was but very little better than pure sand.

I have taken a quantity of sand from the supply to be used for filler purposes and found that it contained thirty-three per cent. of soil.

Thus, I might enumerate for hours the manner, method and means of applying the cement filler in the interstices of a brick street, each and every one of which was but to insure a failure, and in none of which was economy to the contractor subserved.

I have seen, by the use of the same kind of broom in the application of the second course as was used in the application of the first course, the filler swept out of the joints rather than left full and flush with the top of the brick, thereby insuring slight chipping of either edge of the brick in the early use of the pavement. The mere exercise of common sense would suggest the use of a rubber or leather scraper for the application of the top course and the stroke at an angle of 45 degrees to insure a perfect job.

By the proper method, here insisted upon, the hoes are drawn by two workmen to the upper portion of the box and the backward flow agitates the mixture equally with that of the stroke. The lift of the scoop immediately following, the box sufficiently adjacent to the work, so that instead of a motion which pitches, it is rather a quick motion on the part of the workmen that pulls from under the mixture the scoop, allowing the mixture to strike the surface of the brick in proper proportion, thus most nearly insuring it in place in proportion than by any other known method. By the use of three boxes and a systematized force, the greatest economy to the contractor is subserved and the greatest possibility of the cement filler is attained.

The boards in place providing for the cushion should, after a lapse of twenty-four hours and sooner than thirty-six hours, be withdrawn and the space filled two-thirds with a pitch filler. Then finally a covering of sand sufficient to hold moisture and protect the cement filler from extreme heat while setting, is imperative.

The street having been finished in all respects with great care and skill is sometimes entirely ruined by using it before the cement filler is sufficiently set. That this is done seems inexcusable, yet it is done sometimes by the very person who is taxed to pay for the street.

We stand for the cement filler because it meets fully all the requirements. It forms a part and parcel of the ideal brick street which no substitute can supply.

If these conclusions are correct, that our manner, method, and practice is the best and that they do not add greatly to the cost, neither are they difficult, *why are they not generally complied with?* But in asking this question again, please do not misunderstand or infer it is coming from a pessimist. On the contrary, I am exceedingly optimistic in this whole matter. In many cities and smaller towns of the middle west, the public have long since understood what they can have, and they will only have brick streets at their best. In certain cities of northern Ohio, Michigan, parts of Indiana and Illinois, are found the best examples. To such an extent is this true, that at least 80 per cent. of all the pavements laid in the last two years have been brick. Nor do I believe that the municipal engineers of the country are to blame for a non-compliance with these directions in brick street building.

One reason why a compliance with the specifications and directions is not observed is that the performance of each particular step in the construction of a brick street is left to a foreman chosen by the contractor. It is almost universally so that such foreman has his set way of doing this or that particular thing he is charged with, and rebels against an innovation in his practice. We sincerely believe that progress for betterment in this particular may be accomplished by embodying in the contract between the municipality and the contractor, as a part of the requirement, that the contractor be obliged to supply his foreman with particular specifications and directions covering such portions of the work with which such foreman is charged. This suggestion, however, is only remedial to a degree and does not, of course, meet the difficulty in full.

Another reason is that in some localities the results of a properly constructed brick street are not appreciated, because not believed in. But the question becomes interesting in the face of the fact that these specifications have been adopted in the main by practically all the progressive engineers of the country.

But the principal reason why we cannot get a more universal compliance with the approved methods of constructing brick streets is due to the American political practice of rewarding minor political service by the dearest compensation possible to lay hands upon. In many cases the man secures an inspectorship because he is fit for nothing else. The miserable practice should cease. More money is expended for streets and roads than for any other public purpose except only for the education of our children.

The architect who plans, designs and specifies concerning the expenditure of $50,000.00 in a building is permitted to hire, train and direct his superintendent. It is the exception to the rule if the municipal engineer in this country is permitted to do this thing. It should be part of the engineer's business, as much to select his superintendent and inspector as it is to design and specify. This question is one that does not relate alone to the construction of brick streets, but it permeates, relates to all municipal work, and is the one objectionable feature in the prevailing American municipal system, toward accomplishing the elimination of which every broad minded citizen and taxpayer should lend his influence.

DISCUSSION.

THE PRESIDENT: This Society has listened to a great many papers on street pavements, more than on any other one subject. Some of them have been prepared by engineers who have been specially interested in their work; others have been prepared by people who were interested in the laying of the pavements from the contractors' standpoint. This, I think, is the first paper we have received from a man, or rather a body of men, whose sole interest has been, and who have been working for years with this end in view, to get absolutely the best results from this pavement; their idea, of course, being selfish in the main, because they knew that the very existence of brick pavements depended upon their being well made. I think the work that the National Paving Brick Manufacturers' Association has been doing has been wonderfully well done, and that they are entitled to a great deal of credit for it, and I have been very much inter-

ested and very much pleased to listen to this paper, and shall be glad to have a discussion of it, because I know how thoroughly Mr. Blair has gone into the question and how absolutely necessary are some of these apparently small points he has mentioned.

MR. KINGSLEY: I think one thing in Mr. Blair's paper was more important than anything else in brick pavements, and that is this question of placing cement grout in the street. I want to state to the Society and to Mr. Blair that we have a contract just awarded in Little Rock for some 75,000 yards of brick pavement, and Mr. Blair's specifications have been followed exactly in my specifications, and it shall be my endeavor on this contract to see, if possible, that these specifications are carried out. If Mr. Blair can find the time to visit Little Rock during the construction of this pavement, I shall be more than glad to have him spend a few days with my contractor and with my assistant to see that his specifications are carried out absolutely, and if our Society will do us the favor of visiting Little Rock next fall and Mr. Blair will also come out, I will guarantee to show you some brick pavements put down according to the specifications.

MR. PARKER: Until I listened to the able dissertation of Mr. Blair, I was under the misapprehension that I knew something about laying brick pavement. It is one of the ablest papers I have ever listened to; not garbed and clothed in technique, but plain and practical and in words of one syllable and to the point. There are ideas promulgated in that paper that are of interest and worth the attention of every paving contractor, no matter what material he lays. Brick is a factor even in plastic pavements, for there is a great deal of it used in gutter work. I am glad the matter was explained as it has been, and if a motion is in order, I move that the thanks of this Association be extended to the National Paving Brick Manufacturers' Association for their courtesy in authorizing and sending Mr. Blair here to read that paper.

THE PRESIDENTS I am glad to have that motion made. I think we have established a bad precedent this evening in passing a vote of thanks to Mr. Solotaroff. I do not believe we should return a vote of thanks to a member of the Society for reading a paper. I think the motion advanced by the member in this case, however, is eminently proper, because it provides for thanks to the Paving Brick Manufacturers' Association who have been doing good work, and I put it with pleasure.

MR. BLAIR: I beg to say to the President and the association that I shall, with a good deal of pleasure, carry this courtesy to the National Association when it meets in February.

MR. HITTLE: I am rather surprised that Mr. Blair did not speak of transverse expansion joints. Personally I have had some trouble with pavements laid with grout fillers on account of the expansion, and I should hesitate to lay one without the transverse expansion joints.

My experience with the grout filler has possibly not been as satisfactory as I would like to have had it. Before I say anything further, I do not want to be understood here as being an advocate of plastic fillers. Before I left Chicago we had started, and will be ready to lay this year, over 40,000 yards of brick pavements, and I question whether at this time of the year we can get the best results from a grout filler.

There is another point in which I have had a great deal of trouble. All of our alleys are paved with brick. In the summer time, when we attempt to close those alleys for seven days, as our specifications require, to permit grout filler to set, we have found that, not the property owner, as Mr. Blair says, but the city itself has been the offender. We have found that the street tender and especially the garbage department have been the worst offenders. The result has been that we have had nothing more or less than a sand filler instead of a grout filler.

Mr. Blair: In answer to Mr. Hittle's question, I may say a word or two that will economize time in a way. I did not take the time to go over each sample and describe each sample of brick paving I have here, but I shall be here a day or two and shall be pleased to answer any question concerning them. I think I have a sample here illustrating every vital point in connection with brick pavement.

Now particularly as to Mr. Hittle's question: Twenty years ago I thought, myself, that the transverse expansion joint was perhaps necessary. I have long since been convinced to the contrary by the observation of brick streets otherwise properly constructed, affording ample expansion cushion at the edge and along the curb. A few days ago I spent almost an entire day with Mr. Bing, who is Assistant Engineer of the City of Cleveland, Ohio, in which city there are more miles of high class brick street, perhaps, than any city in the world, owing largely to Mr. Bing. I asked him whether, after having followed the National Association directions to his entire satisfaction, every particle of the work being done with skill and in compliance with our directions, he would take away the cross expansion, and do without any cushion at the side, the work being perfectly done to that point. I said, "If you take away the curb entirely, throw it away, will that street ever come up?" He said, "Never." That is my observation in every city that I know of where the pavement has been put down skillfully. Where we have provided liberally so that the street could not catch on the curb and raise up by its own force or by the force of the pressure, we have never found one injured.

Going a little further even, we think the injury to the street coming from these cross expansion cushions (as can readily be observed by visiting some of the older streets of Cleveland and Sandusky, Ohio; Grand Rapids, Mich., and quite a number of other cities) is a greater injury than could come from this cross expansion provision.

As to the condition I know you are confronted with in Chicago and in some of the larger cities, I cannot answer that as satisfactory as I ought to; I do not believe any man can, and the best way to answer that

is a kind of mean way, and if you will excuse the way, I will answer it. Any city, any people that are unwilling to wait a few days in order to get such a sanitation and such condition as must come if allowed to come, ought almost to die of what they do die with—typhoid fever and diphtheria—because the question of sanitation in this country goes right along with the construction of our streets and pavements and must be regarded in the future as being a great deal more important than it has been in the past.

MR. HOWARD: Mr. Blair has most ably described the science of attending to details and the whole construction will be excellent as far as construction is concerned. I personally think, from work on streets for more than twenty years, that it is generally believed that in addition to these details of construction there must in time be established a minimum quality of brick allowed to be used on streets in cities; and I think that will be a matter that will come up at the next convention, and I would suggest that the men interested in this important work which uses so much money might well consider the problem of the quality of brick in addition to this excellent paper on the details of construction.

MR. ANDERSON: Those of us from the West, who probably deal more with the brick than we do with any other material, are peculiarly interested in this paper. I have, however, observed some conditions that I have not been able to fully analyze. I have in mind one street, twenty-five feet wide, in which we provided expansion joints of one inch on each side adjoining the curb. As an additional precaution, we put in one-inch cross expansion joints at every fifty feet, the same width as adjoining the curb, which joints were filled with a bituminous filler. The pavement was down just one year—hardly that—when we began to observe expansion. In one particular place it raised above grade about an inch and a half. Not alone that, but the force was sufficient to crush the brick. That is the only street that I made that peculiar observation on. It may have been due to the fact that the lower part of the street is on a comparatively flat grade, while the upper part is on a steeper grade; or that one side of the street is subjected to shade, while the other is subjected to sunlight, due to the topographic conditions surrounding the street.

I have also observed several other things in connection with the grout filler, one of which is the fact that there is more or less rumbling at certain points. It is not noticeable at first, but after the pavement has been down for some time it develops. Now whether it will gradually disappear in the future, I cannot say, because the pavements have not been down long enough to determine that fact. I do not know what the experience has been elsewhere, but it appears to me that it is wise to make some provision for cross expansion or to put in cross expansion joints. As to the rumbling, I do not know how we can overcome it. The grout filler was put in in a first class manner substantially in comformity with the specifications cited here this evening. Possibly Mr. Blair can throw

some light on those questions. They are questions of vital concern to us because they arouse criticism along the street, and we are desirous of overcoming it.

Mr. Blair: Questions like the one just raised have been raised time and again, and these physical questions of science are mysteries to me, although I have been studying these questions for thirty-five years, and I do not know how to answer that question any more than to say that finally some way, somehow, the solution is to be found, even if it is to be found in the sewer that is hidden away, not readily observed. But I will say this, that to all of the questions that ever have been raised along these lines, the solution is found in a lack of some one thing or another in the construction of the street that fully and completely explains the condition. I have heard a rumbling noise where it was declared, and honestly so, that the rumbling noise took place in a street; that it was there; it was found to be there. In every case so far where the mystery seemed to be so great, I have secured permission from the municipal authorities to go after and find the trouble if possible, even if I had to injure the street, but under the guarantee that I would put it back in first class condition. I have found just such places as Mr. Anderson speaks of, and when we dug into the street we found it was due to lack of compactness of the cushion under the brick; there was a vacancy, and wherever there is a vacancy, there will be a rumbling noise. There are conditions that obtain in some places, as where there is a great weight of pavement upon a hillside and an extraordinary condition of retaining force at the other end, where I have seen the street raised up and buckled in a day. Of course such conditions as obtain there require an extraordinary expansion cushion at the retaining curb at the foot of the hill, so that the street could go down a bit and not come up; because there is nothing that will resist the force of expansion when it takes place, especially if the street is very flat, throwing its weight in one direction. There are a great many streets where the physical conditions surrounding them are as severe as any that could surround streets anywhere upon this earth, where these little objections and annoyances do not obtain, and we have some down now that have been absolutely without repair for twenty odd years. I visited Mr. Anderson's city and looked over his streets, and I will say that if we had such work everywhere as Mr. Anderson has succeeded in doing, the few little remaining points would not be difficult at all.

Mr. Hittle: In our city we experienced some of the identical conditions that Mr. Anderson explains, but we believe they were caused largely on account of the brick being laid in early spring in cold weather when everything was at its smallest diameter. Therefore, when the warm weather came on expansion naturally took place; sufficient space had not been allowed in the expansion joints, and then this heeling took place causing the rumbling noise. We have done a great deal of paving in our

city, and fully fifty per cent. has been brick, all of which has been put down by contractors, members of the National Brick Makers' Association, and in no case has a foreman or inspector ever been forced on them or on city engineers by any political methods. Now why shouldn't the brick makers themselves, through the contractors who lay the streets, adhere strictly to their own rules?

Mr. Rust: We have about twenty-five miles of brick pavement and have not put transverse joints in, and haven't had a case where the brick has lifted. We have used almost entirely cement filling. We used some pitch years ago, but we have had no trouble with the brick coming up.

The President: I think the point made by Mr. Hittle as to laying brick in cold weather has much force. Some ten or twelve years ago in Brooklyn we laid a couple of blocks of pavement on a residence street with a cement joint. It was on a street that was built up with high buildings on each side and many shade trees, so that the street itself was shaded considerably. After the work was completed we had a great deal of complaint about the rumbling noise, and a joint was cut along the curb an inch and a half wide, but that made no difference whatever. The result was that one block was entirely taken up and replaced with another material. That rather frightened us on laying brick pavement. There was another street half a mile long that we were desirous of laying brick on, and it did seem that it would be possible, if we took the proper precautions, to lay the brick and have no trouble from this rumbling. The street ran approximately north and south; the upper two-thirds had a grade of about three per cent., and the lower part was nearly level. It was laid in August and there were almost no buildings on the street and no trees so that the sun shone down on the street all the time. We used cement grout, and did what we thought, and what I still think, was a good piece of work, and we had absolutely no trouble whatever from expansion, with no expansion joint either transversely or longitudinally. I have always thought that the reason for it was that principle referred to by the last speaker, that the brick were expanded to as great an extent as they ever would be on the pavement, probably having a sun temperature on them of 100 or 110 degrees while they were being laid. We had absolutely no trouble and no contraction.

Mr. Andrews: I would like to add my evidence to that. In laying about thirteen miles of brick pavement, most of it in the hot season, no expansion joints were placed either longitudinally or transversely, and the brick has never raised up, although in some places a roaring noise is heard. It has never raised up or broken at any point.

Mr. Blair: I may say that in investigating these questions there is one thought I would like to leave with you engineers. I do not know how much there is to it, I just simply give you the circumstances and the fact. I was informed by a brewer of eminent integrity in this country that they

had spent a very large amount of money in investigating and testing and determining the quality of cements necessary for what they call their sprouting floors. Up to within the last five or six years they never had been able to get a cement floor that would stand for that sort of use,—raised to a high degree of heat and then to a low degree; but this man tells me that after spending a large amount of money they have succeeded in getting a cement that does not expand at all. I do not believe we could ever make a brick that would not, but still a cement without any expansion may have something to do in preventing the extreme expansion of brick streets. I do not know what there is to it, but I feel like saying this much.

CONCRETE PAVEMENTS; THE BLOME METHOD.

By H. S. Dewey, of the Rudolph S. Blome Company.

No subject so deeply concerns your honorable Society as the business of roadbuilding. Other municipal improvements present many interesting features and characteristics that commend themselves to your consideration; but none, I believe, requires so much careful thought and study as the problem of supplying pavements that will effectually meet the requirements of the steadily increasing demands of traffic and sanitation.

In the study of this subject, involving as it does numerous ramifications, all of which affect in a marked degree the public health, comfort and welfare, the engineer finds much that is inspiring. In recent discussions of this subject, engineers have pretty generally agreed that the future pavement, particularly for thoroughfares in the larger and more conjested commercial centers, is still problematical, previous methods and materials having proven quite inadequate for the needs of today.

However divergent may be ideas upon the subject, it is pretty generally conceded that the future pavement for heavy traffic such as is encountered in the larger cities throughout the United States, must present a hard wearing surface capable of resisting the unusual wear and tear of present day traffic, and also possessing in no small degree the very important essential of being sanitary. This latter requirement is one that engages the attention of the health and street cleaning departments of every city in the country and in recent years has developed so much of interest that no pavement which does not possess sanitary qualifications of marked superiority will be approved by health and street cleaning officials. Previous methods of sweeping and cleaning streets are undergoing changes constantly, and those who have made careful study of the work generally agree that no system of cleaning is satisfactory without a free

use of water flushed upon the surface of the streets by means either of hose or of power machines which force the water to the surface of the pavement at a pressure of from fifteen to forty pounds, the pressure depending upon the character of the surface accumulations to be removed. Under such a system of cleaning, any other than a hard and durable pavement will not withstand the treatment that must be applied to successfully remove the dirt which lodges in every depression, crevice and opening in the pavement, forming convenient breeding places for disease germs. This fearful menace to the public health will constitute no small part of the future controversy pertaining to the subject of pavements, their maintenance and care and it is but right and proper that due observation be given to every essential need and requirement of so important a public utility.

In years past when the horse was "King of the Highway," pavements possessing more or less of resiliency were deemed to be most efficacious for general traffic. These pavements were naturally constructed so as best to conserve the prevailing need for assistance and protection to the horse, the natural inclination being to employ lighter and more elastic substances for the purpose of holding the aggregate in place to receive the wear. During the past few years, however, the "Evolution of the Vehicle" has demonstrated conclusively that older methods require material improvement, in fact, demand a revolution in road construction particularly in the larger cities and immediate surroundings, occasioned by the unusual speed at which automobiles are now accustomed to travel and the demands of a constantly increasing traffic. The action of rapidly moving motor cars displaces the softer and more pliable materials which have previously been used in various pavements, and in a comparatively short time destroys every function which heretofore, under former traffic conditions, had been considered ample for existing needs.

These are the conditions that confront the student of the situation today, and there is no reasonable presumption that

there will ever be a waning demand for motor cars, either for pleasure or commercial purposes. On the contrary, there is every possible indication of an increasing demand for this class of vehicles, evidenced by the fact that many of the larger manufacturers of automobiles, both in the United States and Europe, are constantly adding to their present equipment and improving their facilities for increased and added output. Under such conditions it seems only reasonable that the proper solution of the problem of supplying the pavement of the future lies largely in the consideration of necessary provisions that must be contemplated for the purposes of meeting the changed conditions I have referred to, not only in matters of traffic, but also with reference to the sanitary features. The pavement possessing, primarily, a hard wearing surface sufficiently durable to withstand traffic of the kind we now encounter, providing for the demands of sanitation properly and satisfactorily and ignoring no other requirement of importance, is the one which, if not absolutely perfect in every detail, at least more nearly approaches the requirements than any other pavement heretofore presented for your consideration.

Taking as their text the problem of supplying a pavement that would meet the demands of the changing traffic and conform to existing sanitary requirements, the Rudolph S. Blome Company, of Chicago and New York, have evolved methods of their own in a treatment of concrete which possesses many superior advantages. The Blome method is not a creation—it is a development. Possessed of an intimate knowledge of the concrete and cement business, the company have applied important modifications and reasonable and judicious treatment of cement mixtures, experimenting through the various stages of this development covering a period of about twelve years. The unusual task of providing a pavement answering the general demand and ignoring no single element of the diversified traffic needs of the present, is an undertaking which the Blome Company have very carefully studied, and their intimacy with the action of cement and concrete in various mixtures has

enabled them to obtain results which have proven unqualifiedly meritorious. The Blome pavements have been laid under every climatic condition peculiar to the United States. In Calumet, Hancock and Houghton, Michigan, where the thermometer frequently reaches 40 degrees below zero and often ascends to 90 degrees above, during the summer season, pavements have been down for three years without indicating any evidences of fracture or disintegration due to any action of the weather. What is true of this extremely cold climate, is likewise true of the warmer localities where these pavements have been in use in Southern cities for a similar period of time without showing any deterioration caused by the elements. In the City of Chicago pavements have purposely been laid in localities where the heaviest traffic conditions prevail and after a period of from five to twelve years of constant use, show comparatively slight traces of wear and little or no tendency to break or chip; the top levels have been almost perfectly maintained and at the expiration of the guarantee period the pavements have invariably been turned over to the owners in almost as good condition as they were when first laid.

Mindful of the necessity of a careful scrutiny of every condition that is likely to affect so important a utility as a pavement, the Blome methods have taken into account the skidding tendencies of rubber tired vehicles and a wise provision has been made to avoid this dangerous inclination of this class of traffic. By a careful treatment of the surface of the pavement immediately following the laying of the work, ample provision is made to prevent this troublesome difficulty and the results have been highly successful.

Concrete construction is not new. On the contrary it has been in constant use for centuries, though until within the past ten years comparatively little progress had been made in the United States in the general use of the material. This condition is accounted for by the fact that prior to 1898 the manufacturers of cement in this country had but meager information and but a superficial knowledge of the business of making

cement; consequently it was necessary to import the higher priced foreign product, which prevented its use in much of the general construction in this country and necessarily precluded the possibility of becoming universally understood as demonstrations during the past ten years have conclusively shown. Because of these conditions the slow development of concrete construction in the United States may very properly be ascribed and whatever misunderstanding there may now be, can be attributed to lack of knowledge only, for the Blome development has exhibited methods and characteristics which have been proven to be not only useful and lasting, but also conserving needs which heretofore have been but moderately heeded.

The specifications for the Blome system of granitoid concrete blocked pavement are as follows:

FOUNDATION.

The ground shall be brought to a level eleven inches below the final level of the pavement, and then there shall be placed a layer of coarse sand or cinders four inches in thickness. This filling is to be rolled to a true surface, so that the pavement will be of uniform thickness throughout. The contractor must use necessary precaution in preparing the subgrade, so as to support the pavement permanently, and so that the pavement shall remain at the original grade for a period of five years. This clause will not be waived on account of any trenches or holes made in the street prior to the laying of the pavement by any corporation or private party.

All the slopes which shall be given to the street pavement shall be made in the foundation, so that the concrete work will be of uniform thickness throughout. The foundation shall be carefully compacted, either by a steam roller or other suitable means, at the discretion of the engineer. Then the concrete shall be put in place in the manner specified.

MATERIALS.

Cement—Portland cement shall be used, and ordinarily will be subjected to the following inspection and tests:

Fineness: It shall be so ground that 92 per cent. will pass through a standard No. 100 sieve, having 10,000 meshes per square inch.

Soundness: It shall meet the requirements of the "Boiling" test.

Setting: The cement, when mixed with 20 per cent. of water, by measure, shall take initial set in not less than 45 minutes.

Strength: Briquettes, one inch square in section, shall develop the following tensile strength:

Neat (one day in air and six days in water) 400 pounds.

A mixture of one part cement to three parts sand (one day in air and six days in water) 175 pounds; it shall show a gradual increase in strength of 15 per cent. at the end of twenty-eight days.

Sand—All sand shall be clean, dry, free from dust, loam and dirt; of sizes ranging from ⅛-inch down to the finest, and in such proportion that the voids as determined by saturation shall not exceed 33 per cent. of the entire volume. It shall weigh not less than 95 pounds per cubic foot. No wind-drifted sand shall be used.

Stone—All crushed stone used in making the concrete shall be of the best quality of limestone or trap rock; clean, free from dirt, broken so as to measure not more than 1½ inches and not less than ¼-inch in any dimension. The stone when delivered on the street shall be deposited on flooring and kept clean until used.

MIXING AND LAYING CONCRETE.

The pavements shall consist of 5¼ inches of concrete base, and surface blocking 1¾ inches thick, making a total of seven inches exclusive of foundation.

After the subgrade and foundation have been prepared as specified, there shall be deposited concrete composed of one part Portland cement, three parts sand, and four parts crushed stone. These materials to comply with the requirements above noted, and shall be mixed by a machine suitable for the purpose, to be approved by the engineer. It shall be mixed at least six times before being removed from the mixer. The concrete shall be thoroughly tamped in place, and shall be 5¼ inches thick at all points after having been compacted. It shall be laid in sections, with expansion joints (all as per the Blome Company's patents) and shall follow the slopes of the finished pavement so that the surface blocking shall be uniformly of the same thickness at all points.

SURFACING.

After the concrete base has been placed, and before it has begun to set, there shall b eimmediately deposited thereon the granitoid blocking, which shall be 1¾ inches thick. It will contain one part of Portland cement and one and one-half parts of clean, monument, crushed granite or trap rock. This granite shall be screened, with all dust removed therefrom, utilizing the following composition of this material: 50 per cent. of the granite to be of what is known as ¼-inch size, 30 per cent. of the ⅛-inch size and 20 per cent. of the 1/16-inch size. This proportion of sizes is essential, and must be kept absolutely accurate, as in this lies one of the essential requirements to produce proper results. This material to be mixed with the cement thoroughly, and after being wetted to a proper consistency and deposited on the concrete, shall be worked into brick shapes approximately 4½x9 inches, with rectangular surface similar to

paving blocks. This will be done by special methods, and utilizing grooving apparatus as employed under the Blome Company's patents.

EXPANSION JOINTS.

Expansion joints must be provided across the pavement at distances not exceeding 75 feet apart, and longitudinally continuously along the curb or gutter. These expansion joints shall extend through the blocking and concrete, and shall be filled with a composition especially prepared for the purpose.

The specifications are modified to suit local conditions and requirements.

The general idea of laying this pavement is original and the development has eliminated many features commonly supposed to have been identical with the general progress of concrete construction and has added some novel methods, which by actualy experiment, have shown themselves to be highly efficient in shaping the destiny of a project designed to conform to current demands for a pavement of modern times for modern needs. It manifestly more nearly approaches the requirements of today in that it provides greater resistance to the wear and tear of traffic and the elements; facilitates the ease and comfort of the weary traveler; is not noisy; retains its top level almost to the point of perfection; is almost perfectly sanitary and is usefully instrumental in preventing the skidding tendencies of rubber tired vehicles under any and all weather conditions. In the development of the Blome method not all experiments have been wholly successful. None, however, have been failures. On the contrary progress has always been timely and has proceeded with splendid regularity.

There should be little skepticism regarding the adaptability of concrete for paving purposes, for its ancestry contains much that is interesting and highly commendable. From the time when Rome was mistress of the world, concrete contributions to general construction have been numerous and uninterruptedly successful. Contemporaneous with the development of the Blome pavement there has been a general and appreciable development in the demand for cement which augurs well for

this commodity and indications are not lacking to show that there may be, in the future, still further advancement of a most substantial character.

Sane and unprejudiced investigation of our methods is always desirable, and we invite it, for the approval of the engineers is indispensable. Irrational and biased examination is misleading, and while it cannot evoke much sincere criticism, it sometimes gives rise to prejudiced comment which frequently indulges in a specious and fantastic arrangement of words by which a man can prove a horse-chestnut to be a chestnut horse.

One of the objects of the International Road Congress, now in session in Paris, France, is to ascertain what shall be the road of the future. Opinions may differ upon the minor points at issue, but it must be generally conceded that the demands of the situation are imperative and call for a decided improvement. Our contention that a proper mixture of concrete will prove to be most available for all purposes, is made after the expenditure of years of effort to perfect a pavement that would at once serve every useful purpose, ignoring no single element of necessity. To the attainment of this result, the experience of the Blome Company has been carefully applied in every detail with especial care that the need for preparation for future demands of the automobile, for both pleasure and commercial requirements, be not overlooked. These demands and requirements are perfectly evident to any casual observer who may have made but cursory investigation of the subject. To the engineer, the undertaking, surrounded as it is by the uncertainty of materials heretofore utilized, presents a most serious aspect and calls for his best efforts and most careful and thoughtful consideration.

In so an important an industry as we know the business of paving and road building to be, I am sure there will be no curtailment of energy nor lack of intelligent appreciation of every apparent need, not only for present demands, but also with reference to future requirements. I believe that the compre-

hensive system of roadways of the future will contemplate main trunk lines generally throughout the more populous localities of the United States of similar construction to those advocated for roadways adjacent to the larger cities; that the growing demand for automobiles for commercial purposes as well as an increasing popular fancy for the high power machine so generally in use now for the titillation of jaded nerves and the rehabilitation of exhausted energy, will demonstrate the need of such a system and that the question of maintenance will hereafter receive rather more of consideration than it has previously. The initial cost of a roadway or pavement is important, but it is not of such importance as to exclude consideration of the item of depreciation and the elements which now so largely contribute to cause rapid disintegration.

DISCUSSION.

THE PRESIDENT: The paper is now open for discussion.

MR. HOWARD: I want to ask one or two questions. The use of Portland cement concretes for surfaces exposed to the weather, foot travel and wheel travel has been in common and general use for a great many years, but it is only lately that attempts are being made to put Portland cement concrete mixtures upon roadways subject to city traffic. In all our cities, in this country particularly, we have a lot of streets which are in outlying districts, and sometimes near the center of population of cities, on which there is practically no traffic except the butcher and grocer and the ice wagon. Therefore on such streets almost any pavement will do which will resist the weather. The crossings of sidewalks to areas, the areas within large buildings, and other places have been paved with Portland cement concrete, just as this hotel here in its porte cochere. There we find an excellent piece of handmade concrete; I did not see it made, but we know from examination that it is a good piece of concrete. The vehicles that come in here are rubber tired, or perhaps partly not rubber tired; but still the traffic, whether light or heavy, produces no shock, and the brittleness inherent in Portland cement compositions does not, in places like the entrance to this hotel, cause it to break from wheel traffic.

Now on examining a piece of concrete pavement laid through a park at the south end of Seventh street in Washington, going to a bridge across

the Potomac river, and then on the Virginia side and extending through the country there until it comes to the highway, I was led to agree with the army engineer who suggested that in Portland cement concretes it would be better not to have longitudinal cracks, for that pavement is somewhat injured from three sources. The first source or cause of injury, it was built upon made ground and some settlings have caused it to crack. Some few other cracks quite long are formed possibly from the weather; and the third is traffic on the surface, which seems to damage it quite seriously, making extensive repairs necessary, but due largely to this grooving of the surface parallel to the line of traffic more than cross grooving.

From my knowledge of Portland cement concrete pavements, I cannot see wherein the pavement the gentleman has described contains anything new or novel except that which is named in one of the patents which I understand is owned by the company laying this concrete pavement, and the result of which patent is the elimination of dust from the crushed stone used in that mixture, thus putting it possibly in a class by itself if that dust is actually removed from the construction. The official sidewalks of Glasgow, Scotland, and a great many roadways which I have seen at intervals for twenty-four years are made of what used to be called granolithic—crushed granite and Portland cement; the silica of the granite being composed of freshly crushed stone, the cement unites with it splendidly. That was brought to this country by Mat Taylor, and is highly successful for sidewalk and stable floors and runways and other places subject to horse and vehicle travel. It is, in my judgment, or was, the best form of Portland cement concrete combination subject to travel of a reasonable degree known, until this one known as the Blome concrete pavement appeared. What I would like to ask in connection with the Blome method is this. The speaker stated it contained original and new ideas. That company has been laying concrete for various purposes for a great many years, and lately has taken a patent out and has gone into street roadways, and I particularly desire to know what is new and original in the Blome concrete mixture and laying as compared with concretes heretofore laid on roadway surfaces. I do not refer to the grooving, because that is a common practice in one form or another, or the transverse joint, but why the mixture is more durable than any other.

MR. DEWEY: The general idea is the total elimination of dust and the question of size of the granite; the grooving of the top, and the blocking.

MR. HOWARD: Do you regard the blocking as novel?

MR. DEWEY: Yes, the system that is pursued.

MR. HOWARD: What is the method of blocking?

MR. DEWEY: The new method is one that obviates the difficulty you speak of in the longitudinal grooves. We get away from that by blocking it the same as with the brick, laid alternately.

MR. HOWARD: That, of course, is not patented?

MR. DEWEY: Yes, it is.

MR. HOWARD: The grooving of the surface is not a part of the patent? It couldn't be.

THE PRESIDENT: I think we are wasting time in taking this up from the patent end. But every part of the construction end should be brought out.

MR. HOWARD: Is the dust actually removed from your stone, and how?

MR. DEWEY: Well, by careful screening and the total elimination of sand.

MR. HOWARD: How do you remove the dust?

MR. DEWEY: With a sieve and a blower. With reference to the Washington pavement the gentleman speaks of, Blome methods were very injudiciously not pursued by reason of the fact that the War Department desired to use the street, and an inferior quality of granite was used for the top part in portions of it. The portions where our specifications prevailed and the materials used were carefully selected and chosen have not shown the wear. The faulty construction is due to giving way to the request of the engineer and not following our method carefully.

MR. KINGSLEY: Mr. Howard asked if the dust was actually removed. Now if good, hard trap rock is used, I do not quite understand why all the dust and very fine particles are removed.

MR. DEWEY: Simple because that is one of the features of the pavement that we found through the process of development was a hindrance if you left it in. We use a blower to get it out, the same as in a planing mill you use a blower to get rid of the particles to avoid spontaneous combustion.

MR. KINGSLEY: Most of us have found that a certain amount of stone dust is a good thing.

MR. DEWEY: We have not. That is our contention.

MR. OWEN: In placing your upper surface on your lower bed of concrete, do you get a thorough incorporation, a homogeneous mass, or do you have the upper course somewhat separate from the lower?

MR. DEWEY: I will have to refer to our engineer, Mr. Kendrick, for that.

MR. KENDRICK: We have a thorough incorporation, yes, sir. It is a remarkable fact to me that in front of the Western Electric Company building in Chicago there is a street pavement made not exactly as it is now, because the dust was left in, but it has been in four or five years and

there isn't a crack in it, and there are no expansion joints in it either. We have found so far that it was best for general use to put in the expansion joint. It is run clear through to the foundation, but is filled with an elastic medium.

MR. RUST: What about the cost of this pavement?

MR. KENDRICK: Of course that varies with localities. As a rule we have been able to bid on work at less cost than the standard pavements. In some instances it is hard, but as a rule under favorable circumstances it can be put in for less than other standard pavements.

MR. RUST: We have been using concrete pavements for alleys and have also paved two or three streets. The cost has been only $1.20 or $1.25 a yard, but we haven't laid as expensive foundation as Mr. Dewey referred to. We have only four inches of concrete and then a two-inch surface on it. We use a longitudinal joint and also a cross joint; I think too many cross joints. The first pavement is subject to heavy traffic, and the cross joints have chipped a good deal on the edges. The other pavement, laid more recently, has stood up very well under traffic. Some seven or eight years ago the street railway company proposed to extend the street railway line on one of our streets, and the city laid down the concrete foundation. They used the ordinary paving concrete, mixed about 1, 3 and 5, and left the sides of the road unpaved. After we had this work constructed, the railroad company decided to change its line, and the concrete was left. It was subject to all the traffic on the street, which was not very heavy. It has been there seven or eight years, and it is surprising how well it has stood up under this traffic.

MR. HOWARD: What I wished to convey was that, in my opinion, the laying of a Portland cement concrete mixture can be accomplished as well with crushed stone and Portland cement and competent, experienced men, as with crushed stone from which the dust has been partly or wholly removed, plus Portland cement and competent labor. I was trying to draw out why it was an advantage to remove this silica or dust from the mass, from an engineering standpoint.

MR. TRIBUS: If I had been absolutely confident of being elected a member of this Society, I might have presented a formal paper on some experiments in pavements that have been carried on for several years in that portion of New York City, small in population but great in possibilities. We have expended something between a million and a half and a million and three-quarters in trying different permanent pavements and different classes of foundations and under different conditions of traffic. Five years ago we felt that a pavement could be laid to serve many conditions of traffic (not the heaviest), that would be sanitary and but moderately costly. It seemed as if we could take what you ordinarily call the binder course of an asphalt pavement and roll it without a finished asphalt top, and make a pavement that would serve many purposes. We

experimented with it and developed a specification. We found that the proportions in the binder course were not quite proper for a full filling of voids, so we made up the mixtures of different proportion. We developed a specification and started to receive bids, were stopped by litigation, and after some two years succeeded in going ahead with our work. I have here a little piece that was cut out of a pavement of this specification and contract, which shows pretty nearly a homogeneous mass. It may be of interest to look at it. The sides simply show the cut of the chisel and no other treatment other than the roller that went over, except one blow of the hammer on top. That pavement can be laid under New York conditions of labor and prices and the eight-hour law, for from $1.25 to $2.00 a square yard; I think $1.60 or $1.65 would be a fair average. We have some that has been in use for two years under trying conditions—not as good pavement as that—that is apparently as good today as the day it was put in place. We call it a bituminous concrete. It is used on macadam foundation, or where we have heaviest traffic, on concrete foundation, and we have had no complaint because of slipperiness for the horses, though it is in use on grades up to six and a half per cent.

MINERAL RUBBER PAVEMENT.

By Linn White, Engineer, South Park Commissioners, Chicago.

The name mineral rubber, if it attracts attention at all, must excite in the mind of the investigator the questions as to whether the qualities implied by the name are good and whether they are merited.

Rubber implies that it is elastic, noiseless, dustless, non-slippery and impervious to water. Qualify it by the term mineral, and we have added the ideas of permanency and strength.

These are all requisites of the ideal pavement, of which I will venture to name three others: Moderate cost, ease of repair, and a smooth, sanitary surface of an agreeable dark color free from glare. Other requisite qualities of the ideal pavement might be enumerated, such as that the materials of which it is composed must be plentiful and easily obtained, the machinery required must be simple and the labor needed should not require too high a training. These, however, are implied when we say it must be moderate in cost. There is one other minor quality of the ideal pavement which should not be lost sight of, viz.: uniform consistency under a wide range of temperature. This, of course, is implied under permanency, but is so important it should be emphasized.

Granting that I have correctly named the essential qualities of the ideal pavement, the assertion is confidently made that the mineral rubber pavement embodies them to a large degree. However, lest this assertion is called extravagant, I will say what is obvious, that no pavement can be so permanent and strong that it will sustain the heaviest loads indefinitely and never wear out, nor can it be so perfectly rubbery in character that the blows of a horse's hoofs will not produce some noise.

The mineral rubber pavement may be defined as an asphaltic concrete wearing surface, resting upon a base com-

posed of cement concrete, macadam, bonded gravel, bituminous composition or any other sort of permanent, stable base. The asphalt, or asphaltic cement, to give the rubbery qualities desired, must be comparatively soft, of rather low melting point, showing great range of temperature and permanency under extremes of exposure. The mineral aggregate is a well graded, crushed stone and sand mixture, which may contain a proportion of gravel, but the bulk of the larger particles must be angular enough to be compressed together into a well bonded stable mass without entirely depending upon the adhesiveness of the cement to give the bond.

As to the demand for such a pavement, it is unnecessary to say that if it approaches the ideal, the demand will be unlimited. It occupies a middle position as to cost between the very high priced pavements usually laid on expensive city streets, and the low cost methods of road construction which aspire to be classed among the so-called permanent pavements. It is elastic in more than one sense, because the character of construction can be varied by making the wearing surface thicker or thinner, the foundation of a heavy concrete or a more cheaply constructed macadam, and the stone aggregate of such a grade of stone as may be required by the conditions of travel. An old macadam road forms an excellent foundation if made free of dust or mud and having a coarse, grainy surface. The wearing surface, having a stability of its own, does not creep or roll under traffic, and if the foundation proves somewhat weak, the pavement, by reason of its elastic and self-healing qualities, may be depended upon to adjust itself to the conditions.

A pavement may have one prominent, excellent quality, such as great strength, or durability under iron-tired traffic, but it may be so noisy, non-resilient, or full of unsanitary joints as to be accepted only in ignorance of a better or as a last resort. On the other hand, it may commend itself only by its cheapness or its smoothly coated surface and be found

to be only a temporary expedient or suited only to very infrequent travel.

The mineral rubber pavement is believed to occupy a conservative middle ground, capable of variation in strength and cost to suit the traffic condition, always remaining an elastic, non-slippery, non-absorbent, non-dust and non-noise producing pavement. The name, mineral rubber pavement, was given to it because, as recited above, its qualities seem to be well fitted by such a name, and as the result of an apt remark made by a city official after a section had been laid on a street over which he had charge. Observing its good qualities, he said, "I always thought I should like to build a rubber road, and here I believe we have it."

If I seem somewhat enthusiastic in enumerating the good qualities of this pavement, let the enthusiasm be credited to the pleasureable emotions of an engineer who believes he has found a solution of some of the most vexing problems he has met with in his practice.

The mineral rubber pavement has been developed in Chicago. It is an outgrowth of the conditions which existed on the streets and boulevards of that city, and is the result of a conscientious effort to find some means of bettering the driveway surfaces without excessive cost. The principal boulevards of Chicago, under the control of the Park Commissioners, carry a large volume of traffic from which the heaviest teaming is mostly excluded. The boulevards in the downtown district, such as Jackson Boulevard, running east and west through the center of the city, and Michigan avenue, north of Twenty-second street, have long been paved with standard sheet asphalt. But south of Twenty-second street and north of Chicago avenue, up to within the last two or three years, the best efforts of the park management have been directed to trying to maintain macadam road surfaces. Before the advent of the automobile in such large numbers, and I may say, before quite so high a standard of road and street construction had been set up, it was possible to do so. Well crowned and well drained

macadam roadways twelve inches thick, the upper four inches of granite, bonded with limestone screenings or a natural cementitious gravel, were considered the acme of good road construction for driveways from which traffic teaming is excluded. But by, say, about 1905, it had been thoroughly impressed upon the minds of the Commissioners that water sprinkled macadam roadways could not be maintained in a satisfactory condition with the expenditure of any amount of labor or money. The constant interruption of travel for repairs was one of the difficulties which had developed under existing conditions. So, in 1905, the South Park Commissioners took the lead in the experiments with various oils and tar preparations as dust layers and road preservatives. At first it was thought if the dust could be allayed, or its formation prevented, the raveling of the macadam would be stopped. Soon it was found that the lighter oil or tar liquids, though reasonably effective in preventing dust, added so little material of a binding quality to the road surface that the raveling continued. It was then realized that to get any real lasting results, at least the upper layer of macadam must be penetrated and bonded together with the preservative material. This led to the use of specially prepared tar composition and the heavier asphaltic oils which require heat in their application. This kind of treatment has been continued up to the present time with varying and sometimes unsatisfactory results.

The Chicago boulevards and park drives carry a daily traffic of from 500 to 10,000 vehicles per day and where the traffic exceeds 1,000 to 1,500 per day, the best of the surface treatments have been found inadequate. Careful study was then made of the various paving materials and processes on the market with result that preference was given to some form of bituminous sheet pavement with a crushed stone aggregate. This, of course, included any of the forms of tar macadam, asphalt macadam or bitulithic. As a practical expression of the preference for this class of pavement, the South Park Com-

missioners contracted in 1907 for about 75,000 square yards of the bitulithic pavement. In the meantime studies and experiments were continued in the belief that better results could be gotten by the use of better binding materials, and more economical results by the use of simpler methods. As a result, the first block of what has been termed mineral rubber pavement in the South Park System, was laid on Michigan avenue in May, 1908, with full confidence of good results. This block was laid with a wearing surface two inches thick on an old macadam base, which was given a light top dressing of new crushed limestone and rolled dry without the addition of any binder stone. Subsequently other sections of this pavement were laid in Chicago on Grand Boulevard, the Lake Shore Drive in Jackson Park, the North Short Drive and in Lincoln Park. The confidence felt in its good qualities were fully vindicated by its behavior during the past unusually hot summer, not the slightest defect or sign of movement having been discovered in the surface.

All of the above mentioned pieces of pavement were laid on old macadam base, one block, on Grand Boulevard, having a wearing surface only one inch thick. This pavement has also been laid during 1908 in Kenosha, Wis., and Hammond, Ind.

A technical description of this pavement is best given in the following quotation from the specifications.

After the base is prepared, which may be, as said before, Portland cement concrete, macadam (either old or new), or bituminous composition, proceed as follows:

WEARING SURFACE.

On the base constructed as specified, a wearing surface of mineral rubber asphaltic concrete shall be laid with a minimum thickness of two inches after compression, made up of crushed stone of various sizes with a sufficient amount of sand, screenings and stone dust, to fill the interstices and reduce the voids to a minimum, and with enough mineral rubber asphaltic cement to coat all the particles and make a well filled and water tight paving mixture.

The proportions of stone and sand shall be such as to produce the densest practical mixture, and shall be approximately as follows:

Crushed stone (so varying from ¾" to ¼" in size as to produce a mixture of approximately one-third each of ¼", ½" and ¾" sizes)	2/3
Fine stone screenings	1/6
Torpedo sand	1/12
Fine sharp sand	1/12

If the crushed stone, as it comes from the crusher, is fairly well divided between the sizes specified, it will not be necessary to separate them, but all dust and screenings below one-quarter inch must be removed and afterwards added in order to procure the specified quantities. The crushed stone and screenings must be made from a hard, sound limestone, granite, or trap rock, and must be free from clay, loam or other objectionable material.

The sand shall be a clean sand, of the two grades specified above, and may be a lake shore, river, or bank sand, but shall be free and clean from loam or clay, and must not be coated with any foreign matter.

MINERAL RUBBER ASPHALTIC CEMENT.

The mineral rubber asphaltic cement used in the wearing surface shall be sarco road compound, No. 251, manufactured by the Standard Asphalt & Rubber Company, of Chicago, or any asphaltic cement equal thereto.

Samples of the asphaltic cement the contractors propose to use must be furnished to the engineer with all bids, and must be shown by analysis to comply with the following requirements, such analysis to be made by a chemist experienced in the analysis of hydro-carbons.

The asphaltic cement shall be 99.5 per cent. pure bitumen, soluble in carbon disulphide (CS2). Such bitumen shall contain from 73 to 76 per cent. petrolene, soluble in petrolic ether of 86° Baume, and from 24 to 26 per cent. asphaltene, soluble in chloroform and not soluble in such petrolic ether.

The melting point of the asphaltic cement shall be not less than 180°F., nor more than 190°F.

Using the Dow penetration machine, the asphaltic cement shall not vary more than five millimeters in penetration from the following standard:

42 Mil. at 32°F., with 200 grams weight on No. 2 needle for 1 min.
62 Mil. at 77°F., with 100 grams weight on No. 2 needle for 5 sec.
114 Mil. at 115°F., with 50 grams weight on No. 2 needle for 5 sec.

The asphaltic cement shall be of a specific gravity of 98.5 at 77°F., and weigh 8.2 pounds per gallon, U. S. standard.

When 20 grams of the asphaltic cement are heated in a dish 2¼ inches in diameter, 1⅜ inch deep, for seven hours in an oven, the interior of which is maintained at a constant temperature of 325°F., it shall not lose in weight more than one-half of one per cent.

The mineral rubber asphaltic cement shall be used in the proper quantity to thoroughly coat all the particles of the mineral aggregate, bind them together, fill the voids remaining after compression, and make a water tight paving mixture. The quantity of asphaltic cement necessary to produce these results will vary somewhat, according to the character of the aggregates used, but will not in any case exceed ten per cent., or be less than eight per cent. by weight of the total mixture.

After being rolled, the surface shall present a granular appearance, showing that the structural body of the pavement is crushed stone. The asphaltic cement shall be in sufficient quantity to bind and fill the mixture as specified above, but not to flush to the surface as free cement under the roller.

METHOD OF MIXING.

The stone, sand and screenings shall be placed in proper proportions in a properly designed dryer and thoroughly dried before combination with the mineral rubber asphaltic cement.

The drier shall be of the revolving type or some other type which thoroughly agitates and turns the material during the process of drying, thereby preventing any caking of the material or adherence of dust to the surface of the stone.

During the process of drying the aggregates shall be thoroughly mixed and heated to a temperature of from 300°F. to 350°F., and before cooling or exposure to moisture shall be mixed with the mineral rubber asphaltic cement, as further specified.

The mineral rubber asphaltic cement shall be melted in a properly designed tank arranged so the heat can be properly and easily controlled and regulated. When melted and raised to a temperature of from 300° to 350°F., it shall be combined in the proper proportions with the hot stone and sand, and immediately mixed in a properly designed mixer with revolving blades until a thorough and intimate mixture of the ingredients has been accomplished, and the mineral particles evenly and thoroughly coated with the mineral rubber asphaltic cement. The mixer shall be arranged so as to retain the heat during the process of mixing, but shall not be exposed directly to the action of the fire.

The materials entering into the paving mixture may be either measured or weighed, but in either case the means of obtaining the proper quantities shall be simple and positive, and easily controlled, so that even results may be obtained.

METHOD OF LAYING.

While still hot from the mixer, the paving mixture shall be spread on the macadam, or concrete base, and the edges having been tamped as hereinafter described, compressed with a 500 pound hand roller.

The best results are obtained by spreading and rolling at as nearly the mixing temperature as possible. Therefore, if the paving mixture is

hauled in wagons any considerable distance, tarpaulins must be used to cover the loads.

The drying and mixing plant shall be placed as near as possible to the work, and if practicable, immediately on the street itself.

The material may be spread with hot rakes by the same method employed in laying sheet asphalt pavement, if approved by the engineer, but the better method is as follows:

At distances apart of six or seven feet measured along the length of the street, set forms or leveling strips, the tops of which are to be the grade and crown of the finished pavement. These strips consist of planks ten or twelve inches wide, of a thickness to give the desired thickness of pavement, held in place by long spikes driven through into the macadam base. These strips should be in as long lengths as practicable to handle easily, as they will then bend more readily to the crown of the street.

The asphaltic concrete is then dumped between the first pair of leveling strips, roughly spread with rakes, or shovels, and then struck off to a true surface with a straight edge, the edges tamped and the mixture compressed while hot with a 500 pound hand roller. The strips are then moved forward and reset for the next spaces and the spreading and straight edging of the asphaltic wearing surface continued.

The five ton steam roller shall then be brought on the freshly leveled material as soon as it is sufficiently cooled to bear the weight. The rolling shall be continued in both directions as long as any compression can be obtained.

As the leveling strips are moved forward the leveled and rolled surface of the pavement may be used to guide the rear end of the straight edge.

Where the rolling is done up to the leveling strip before it is removed and the next section spread, the edge of the rolled material shall be roughly cut and broken down and painted with a coat of pure mineral rubber asphaltic cement before the newly spread material is joined to it.

Along the gutter lines, around manhole covers, and other places where the roller cannot reach the material, the compression shall be gotten by the use of hot iron tampers.

SKIM COAT.

As the rolling is finished, and while the surface is still fresh and clean, a skim coat of pure mineral rubber asphaltic cement shall be applied by pouring, and shall be spread with rubber squegees, the object being to even up the slight depressions and irregularities in the surface of the asphaltic concrete, and provide a topping of pure asphaltic cement, into which the top dressing of sand or gravel is to be rolled. This skim coat shall be poured on at a temperature of about 300°F.

TOP DRESSING OF SAND OR GRAVEL.

While the skim coat is still warm, a top dressing of coarse torpedo sand, fine, clean gravel, or stone chips, free from dust, which shall

previously have been heated to a temperature of about 300°F., shall be spread thickly enough to well cover the surface, and rolled with a five ton steam roller, more of the material being added, and the rolling continued until the skim coat is thoroughly filled and no more of the material adheres to the surface.

The surplus sand and gravel shall be left on the street surface for at least two weeks after the street is opened to traffic, and then any surplus not taken up by the skim coat may be swept off.

Special attention is called to qualities of the asphaltic cement specified, as to its low melting point, stability under temperature changes, and its very small loss under the evaporation test. It is such qualities as these that give it its rubbery qualities and justify belief in its permanency. Without them it would differ but little in its composition from other asphaltic concretes.

Aside, however, from the virtues of the material entering into its composition, the method of laying the pavement is a large factor in producing it at a moderate cost. A portable machine has been devised which in itself is a combined drier and mixer, with melting tank for asphalt and measuring devices for the asphalt and mineral aggregate. All the working parts of the machine are enclosed so that none of the heat is lost in the processes of combining and mixing the materials. It is strictly portable, being mounted on its own trucks so it can be drawn by horses or a light traction engine. The ability to place the machine on the street where the pavement is to be laid makes it possible to deliver the paving materials fresh and hot from the mixer, without any separation due to long hauls, and keeps the whole operation in the hands of one working organization, under one superintendent and one inspector. The machines are manufactured by the Standard Roadways Company, of Chicago, Ill.

THE HASSAM PAVEMENT AS A SOLUTION OF ROAD CONSTRUCTION.

By Claude A. Magill, General Manager, Connecticut Hassam Paving Company.

In the search for a road construction that would not be prohibitive in its first cost, long and extensive experiments with road material, involving the use of bituminous substances, have been made, and these have met with various degrees of success.

It has been found, however, and is objected to in all these methods of road construction, that wherever anything of this bituminous nature is used as a binder in the road material, an effective binding is not obtained to any degree of permanence.

Sooner or later the action of the elements, of temperature, oxidation and moisture, deteriorates all of these bituminous compounds; their effect as a binder is lost and the disintegration of the roadbed rapidly ensues.

With methods of surface coating it is claimed with truth that the dust is laid for some time; but a constant and increasing tendency of such surface toward disintegration, and also to peel from the underlying foundation, is not successfully corrected and constitutes a most objectionable feature of such work. The underlying broken stones are not at once fully exposed and uncovered, but in a very short time the surface is stripped from them in patches, which become more and more numerous, and of greater extent, and consequently very soon constitute a badly damaged road of very inferior value and little permanence.

The extraordinary wear of fast or heavy motor cars demands a far more resisting and fast bound surface. The long use and experimentation of Portland cement has proved it to be the strongest and most durable material to use for a binder that is known at the present time.

Reasoning from this standpoint, it is manifest that a macadam style of road, so constructed that its stone should be fast bound with Portland cement, would best realize the present requirements of ideal road construction.

Such a proposition presents itself as extremely simple; but all undertakings to construct a pavement in this way have encountered many difficulties.

It has been found that all of the usual methods of mixing such concrete material very imperfectly accomplished the requisite close incorporation of the cement and sand binder with the crushed stone. This concrete, when thus laid, showed far too many and too large spaces in which the requisite percentage of stone was lacking, and where only binding material existed to stand the wear of traffic. Such spots in the pavement would wear more quickly than those in which the percentage of stone was greater, and as a consequence hollows would here occur in the road surface, which thus became hummocky and rough.

To overcome these deficiencies was the first effort in the development of the Hassam pavement, which, as a result of many long continued and careful experiments, has at length achieved the desired result—a monolithic road construction accomplished by a maximum compaction of stones, firmly and thoroughly bound and unified with Portland cement.

Laboratory investigations of the usual concretes, as they were formerly and are now usually mixed, showed such material to be composed of only about 60 per cent. of stone and the remaining 40 per cent. to be the sand and cement filling of the spaces that were left between the crushed stones of the concrete.

A first series of experiments showed that this bad condition could be greatly ameliorated by first placing selected sizes of the crushed stone onto the roadbed, and there compressing it by rolling while it was still dry, and before adding a binder. There was thus obtainable a concrete of a composition of about

90 per cent. of stone, the remaining minimum of spaces being filled by the sand and cement binding material.

Such construction was quite ideal, but considerable practical difficulty was encountered in its application to the usual street work. It has been demonstrated, however, that by laying the crushed stone dry and compressing it with a roller, then adding a grout of cement and sand and again rolling thoroughly, it is very easy to obtain a concrete bed of which at least 70 to 80 per cent. is composed of the stone material.

Moreover it has been found that this successive use of the rolling process eliminates all air bubbles, and voids that are always to be found in the usual concretes, when mixed in the ordinary way.

In our first use of the methods of the Hassam pavement, it was usual to first lay a foundation, about four inches deep, of egg-size crushed stone. This was then thoroughly rolled and grouted with a binder of one part of cement to four parts of sand to which enough water was added to make it of the consistency of cream.

Over this foundation layer was then placed another, two inches deep, of crushed stone of chestnut size, which was then rolled and grouted with a mixture of one part of cement to two parts of sand and water enough to make it of the consistency of cream. Over this was spread a final surface—the wearing coat—about one-half inch in thickness, and made of a mixture of one part of fine pea stones, one part of sand and one part of cement. This surface was not rolled on, but evenly distributed and broomed on to the underlying layer. In practical working of this method it was very often found to be difficult to succeed in the placing of the surface coat, before the bottom layer had taken its initial set. It frequently occurred also that it was difficult to secure a perfect union and binding together of these several layers of the roadbed.

As a result of practical experience with such construction and because of the difficulties mentioned, it was then deter-

mined to construct all further pavement as a solid *monolithic mass.*

This we have succeeded in realizing as a perfectly satisfactory and practical method of road construction.

To construct such monolith, crushed stone that will pass a two and one-half-inch mesh, but is retained by a one-inch mesh, is distributed in the roadbed to make a uniform depth—usually of six inches. The stone is most thoroughly rolled, and then grouted with a mixture of one part of cement and two parts of sand, watered to the consistency of cream, and the whole then rolled again.

This method of construction has given the most satisfactory results. A maximum degree of compact concrete is obtained in which the percentage of actual stone material is very high, and the remaining spaces that are ultimately filled with the binder, are so small that whatever the amount of the more rapid wear of the latter that may take place, it can only result in maintaining a slight roughness of the surface of such pavement, which also has its practical advantage in preventing it from becoming slippery.

While first working on this idea of a monolithic roadbed, it was thought that expansion joints might be needed to permit its longitudinal and lateral expansion and contraction, in accordance with the varied action of the variations of temperature upon this solid mass.

Such joints were made by employing bituminous material at distance of every 150 to 200 feet. It was soon found, however, that every such joint was a point of least resistance to wear, which was quickly apparent at these joints and nowhere else. In consequence, it was determined to lay the pavement strictly monolithic, and without any longitudinal expansion joints.

In fact, as these pavements are laid in warm weather, and as a consequence, it is found that no expansion really takes place. With the advent of winter, however, there is a contraction, and as a result of the periods of greatest cold, there may

appear at intervals of every 200 feet or so, a certain amount of slight cracking of the surface cement, the result of the contraction of the monolithic mass.

Such cracks are very slight, so small as to be scarcely noticeable except to one looking for them. They are purely superficial and do not penetrate down into the mass to any appreciable extent.

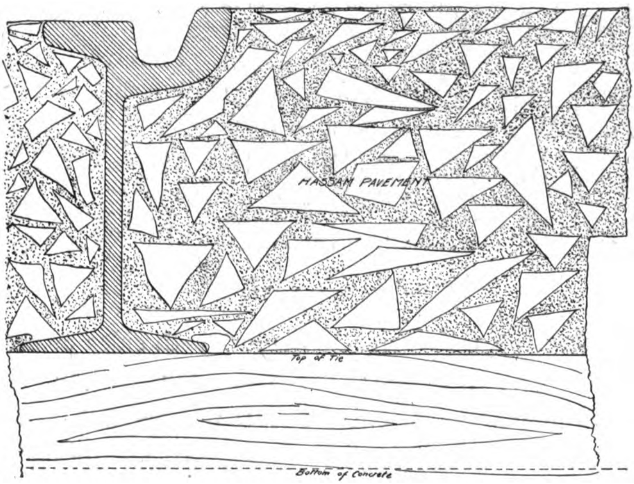
With the return of warm weather again, they close completely and are no longer to be seen. The pavements are uninjured by the penetration or freezing of water at these points and show no signs of wear there.

Such cracks are therefore negligible from a practical point point of view, and it has been found most advantageous to do without any joints for expansion of the pavement longitudinally.

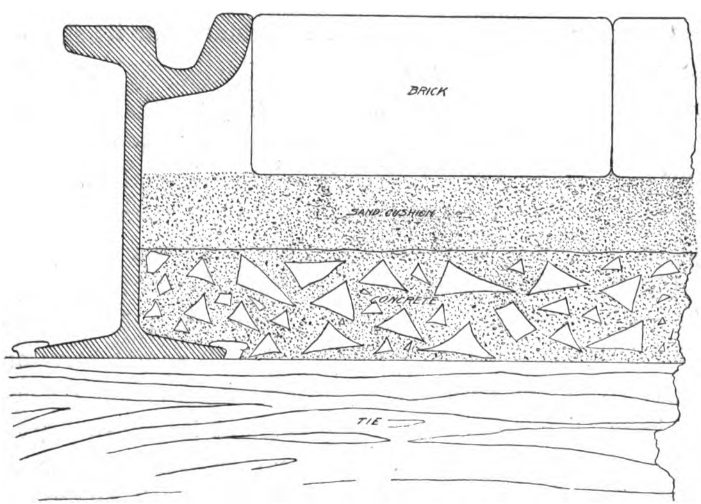
The same cannot be said relative to the provisions to be taken for the lateral expansion, but for quite other reasons than those of expansion and contraction of the monolith. Where this pavement has been laid close up and uniting with the curbing, it is impossible to remove or change a curbstone in any way without involving a destruction of a portion of the paving. Moreover, when the concrete monolith is thus united without joint to the curbing of both sides of the street, a solid arch from curb to curb is thus formed. When this arch is also solidly continued by concrete sidewalks to the buildings, heavy trucks passing over the solid concrete arch of the street caused a certain amount of vibration that was communicated by this continuity of solid construction to the buildings themselves, increasing the noise of the traffic.

The breaking of the solidity of the construction by the interposition of a joint between the curbing and the pavement, completely does away with this transmission of vibration of the street to the buildings, and as it also permits the changing and resetting of the curbstones at any time, without interfering with the utility of the surface of the pavement, it is for these reasons best to use the expansion joint for the sides of the pavement next to the curb.

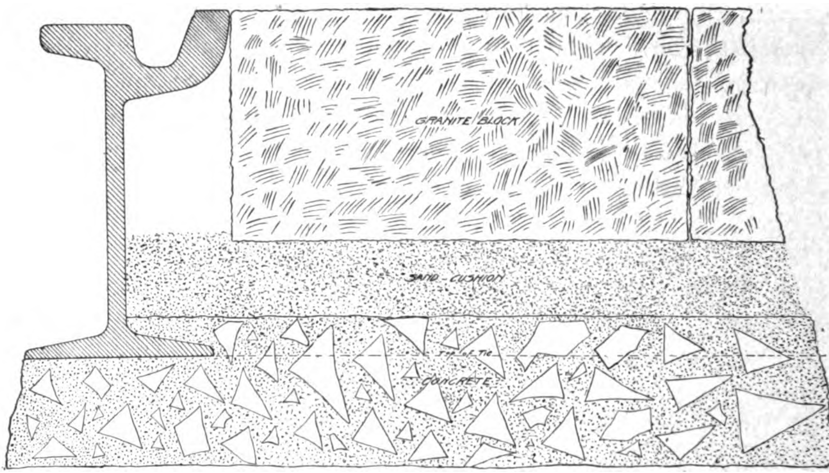
Our experience has shown us a very great advantage of this monolithic pavement construction for use with rails of street railways, railroad yards, etc. When utilized in this connection the concrete material underneath and right up to the rail is rolled to compress it all about the rail with which it thus makes a perfect, fast and tight union.



HASSAM PAVEMENT.



BRICK PAVEMENT.



GRANITE BLOCK PAVEMENT.

The concrete is rolled tightly against both sides of the rail and thus imbeds it in the solid monolithic construction.

You will note how the concrete surrounds the web of the rail and serves to maintain its position irrespective of its fastening to the tie while at the same time the concrete presses up, under and around the ball of the rail, holding all firmly and guarding as well from any up or down motion of the rail or its shaking, as from any lateral variation.

By reason of the perfectly hard and fast rail that is secured by this construction, the smooth passage of the car wheels without battering of the rail ends is secured and the consequent wear upon the loose joint of a rail is thus absolutely eliminated by the tight union, which also prevents the infiltration of water and the consequent deterioration of the railway.

We recognized that an ideal pavement must have a first cost that is not prohibitive of construction on an extensive and rapid scale. The materials for such work must be simple, easy to obtain in all localities and the process of laying such pavement must be so simple as to permit an ease, thoroughness and rapidity of inspection that shall be competent without requir-

HASSAM GROUT MIXER.

STEAM ROLLER FOR HASSAM PAVEMENT.

ing expert services. Such pavement must be free from dust or mud, must have a surface that is easily kept clean, is hard, lasting, but not slippery, and shall not be injured by water, snow and ice, and the wide range of climatic conditions and changes occurring in this country.

It is also very necessary that such pavement shall be easily and rapidly replaced and repaired when opened, in such manner as to completely re-establish its original perfection of uniformity, strength and continuity of surface.

The machinery and materials used must be of such nature as to be easily procurable, easily transported to the places of use and capable of being run or handled by the usual grades of labor obtainable in these localities.

All of these conditions are successfully met by the Hassam pavement. Its first cost is somewhat in excess of the usual macadam, as at present constructed, but not prohibitive. Its cost of maintenance is very low, indeed, so low in fact, that by that single advantage taken alone it rapidly eliminates the consideration of any macadam construction as a competitor. The first cost of the Hassam pavement is far less than that of any other pavement of any degree of permanence and durability.

With a view to replacing the macadam of the usual type in the construction of state roads, it may be interesting to point out that the Hassam paving may be laid like the macadam and requires no curbing.

The equipment necessary for laying this paving is of the most simple nature, consisting of a steam roller, a special (Hassam) grout mixer, and the ordinary picks and shovels of the laborers.

The materials required are easily obtainable in every locality, consisting only of crushed stone or gravel, sand and Portland cement, the nature and quality of all of which are easily determined by any engineer.

This pavement has been laid and is in daily use in the following cities: Boston, Mass.; Biddeford and Lewiston, Me.;

Brockton, Mass.; Cambridge, Mass.; Derby and Hartford in Connecticut, as well as in New Haven, New London, Shelton and Waterbury of the same state; Los Angeles and Oakland, Cal.; Portland, Ore., and Portland Me.; Lowell, Lynn and Somerville in Mass.; again and likewise in Worcester, Spencer, Fall River and Taunton in the same state; Manchester and Nashua in N. H.; Plainfield in N. J.; Montreal, Canada; Niagara Falls, N. Y.; Saginaw, Mich.; Phoebus, Va., and St. Joseph, Mo., where they only take things when proven, you know.

The largest single contract for the laying of Hassam pavement is that recently completed for the construction of the Motor Parkway on Long Island, of which a little more than nine miles has been made ready for the automobile races of this year.

DISCUSSION.

MR. KINGSLEY: The gentleman made one statement in his paper regarding the cracks in the pavement that might appear due to contraction, I presume, in the winter time; and then he made the statement that in the summer these cracks healed themselves. I would like to ask him if he does not experience some trouble from breaking and some trouble from the fact that dirt and sand and material may get into these cracks, so that when expansion comes in the spring it would flake off or break the concrete?

MR. MAGILL: In regard to those cracks I would say that the first winter I observed them I did not pay any particular attention as to their location, and I was very much surprised the next summer to go through the same streets and find I couldn't find where those cracks existed; so last winter I marked several of them on the curb so as to locate where they were; but this summer, on visiting the street, I could find my marks, but the cracks had disappeared and I could not find where they were in any way.

MR. KINGSLEY: There do not seem to be anything but just surface cracks?

MR. MAGILL: Simply a little line; you couldn't put a knife blade into it.

MR. KINGSLEY: Another point was in regard to the expansion. Did you mean to say that no longitudinal expansion joint next to the curb was necessary?

MR. MAGILL: No. Next to the curbstone we use the expansion joint, but not cross expansion.

MR. HOWARD: Didn't you use expansion joints at one time to quite an extent?

MR. MAGILL: Yes, sir.

MR. HOWARD: Those you regarded as failures?

MR. MAGILL: Yes, we used them at first, but we have now abandoned the cross expansion joints entirely, as we found them the weakest point in the pavement.

MR. HOWARD: Didn't that material sometimes, when sudden heat came on, force or spew itself upwards three or four or five inches and then break off and lie over?

MR. MAGILL: Never as far as that, but it would come up and lie on the surface and then break off, and we have abandoned entirely the cross expansion joint. Of this motor park road on Long Island we have just made considerably over nine miles and there isn't an expansion joint there.

MR. HOWARD: There you have woven wire below.

MR. MAGILL: Yes, sir.

MR. HOWARD: Isn't it probable that when the pavement does shorten, infinitesimal cracks form here and there crosswise and then probably fill with the debris from the surface, and then that debris in those small cracks becomes the expansion joint?

MR. MAGILL: That may be; they are not observable at all.

MR. BLAIR: There is a little sentiment expressed by the writer in the prelude to his paper which I want to criticise a little bit, and that is the taking off of his hat to conditions in Europe as compared with conditions in this country with reference to their roads. I do not subscribe to that altogether. I think that in a comparative way the roads and highways in the State of Indiana for the last twenty-five years have got Europe skinned alive.

MR. CORSON: This pavement is laid in layers?

MR. MAGILL: No, sir, not now. Our first pavements were laid in layers. Now we lay it in one monolithic mass and the rolling is done on top of the surface. In putting in the stone, we roll it in layers.

MR. CORSON: Do you roll after the grout is in?

MR. MAGILL: Yes, sir, on the surface.

MR. CORSON: With the same weight roller?

MR. MAGILL: Yes, sir.

MR. CORSON: Don't you grout the monolithic mass when it is first placed, and then after administering the top mixture, don't you roll it again with a lighter roller?

MR. MAGILL: No, we roll with the same weight roller, and after the grouting we do not add any more material. There are some places that settle, or something of that kind; then we add more to it.

MR. ANDREWS: How do you mix your grout?

MR. MAGILLS One of cement to two of sand.

MR. ANDREWS: I mean the appliance you use. Do you have machinery?

MR. MAGILL: We have a machine mixture. It is mixed in a machine and delivered to the pavement through a pipe, and we use the tandem roller.

THE SECRETARY: How long probably would elapse between the mixing of the grout and the termination of the rolling? It has always seemed to me that the idea that cement, which begins to set soon after it is mixed, should not be disturbed until after it is set, was violated by the method of laying this pavement.

MR. MAGILL: A half to three-quarters of an hour after the grout is applied.

THE SECRETARY: And you do not find or think the preliminary setting is broken by this rolling?

MR. MAGILL: No, sir, not at all.

MR. MERIWETHER: Do you prefer a slow setting cement for that purpose?

MR. MAGILL: Yes, sir.

MR. TRIBUS: What initial set do you usually get on that cement?

MR. MAGILL: About an hour.

MR. CORSON: Could that machine of your be used for grouting brick work?

MR. MAGILL: Yes, sir. We have laid a good deal of brick work and have used the machine for doing the grouting.

MR. CORSON: How far is the outlet of the machine from the brick street?

MR. MAGILL: In elevation? Two and a half feet in some machines; in others eighteen inches.

MR. ANDERSON: What is the character of the surface finish of this pavement; how is it finished?

MR. MAGILL: The surface finish presents an appearance somewhat the color of an asphalt, but a little bit rougher. There is a little of the surplus cement after the rolling that lies on top, leaving very slight ridges. Those ridges wear off after very little traffic.

MR. ANDERSON: Do I understand then, that the surface is not given any additional finish besides the rolling?

MR. MAGILL: No, sir.

MR. MINER: It strikes me that possibly the choice of the stone used in this concrete is very important. I think the speaker said he used stone that would go through a two and a half inch sieve and would be retained on a one inch mesh sieve. Possibly that wasn't what he meant, for anything that passed a two and a half inch mesh, there would be nothing left for a one inch to separate. How do you arrive at the proper size?

MR. MAGILL: Turn them the other way around. Retain them on the one inch mesh and let them pass the two and a half inch mesh, and we get the stone we use.

MAINTENANCE AND REPAIR OF ASPHALT PAVEMENTS

By G. H. Lutz, Equitable Asphalt Maintenance Company, Kansas City, Mo.

When I was favored some weeks ago with a request by your Secretary to read a paper at this convention I told him it was something I had never done, but that I would be glad to tell you things in my experience that I know will be of interest to some of you along the line of maintenance and repair of asphalt pavements. There may be some present not interested in asphalt pavements, and you are at liberty to go out and I shall not be offended; but do not stay long, because later on I may have something to tell you that may interest you. I do not feel that it is necessary to make any excuses or plea for the asphalt pavements or try to get you to like them. We have a large amount of it on our hands; we have hundreds of miles of asphalt pavements—someone has liked them or they would not have gotten down.

I find one objection to asphalt pavement, and I thought the asphalt people were the only ones to have trouble until I heard some of the eminent papers read here on various other pavements. They seem to have some troubles, too. But the asphalt pavements have had their troubles and probably do yet, and one objection to them is their cost of maintenance; and it is really the only real objection I have ever found to them, because the asphalt pavement embodies all the features we desire in a modern pavement. It is perfectly sanitary. I have read some very valuable papers from some of the eminent gentlemen present in the room today who have tabulated the different pavements in vogue at that time, and seemed to give asphalt a place at the head of the list of all pavements, except those of macadam; having the first place in non-slipping, the greatest tractive force, and I have watched and studied this condition since coming into the asphalt engineering work, and we have in Kansas City several streets with asphalt on the side,

granite in the center, and in another instance, brick in the center, and I have watched these very steep places in all classes of weather, and it seems the teamsters like the asphalt, whether wet or dry, in preference to the center of the street.

In touching upon the subject of the maintenance of asphalt, I want to say in connection with the expense of such maintenance to the contractor that it costs him more per yard to repair the pavement than to originally lay it. You can readily see that they can spread a large amount of material with a few men and get rid of it quickly, where it takes much time to cut out the holes, tamp the asphalt smooth, and get them back to grade. Having done work as a contractor, I know that frequently where the contractor does that work for from $1.25 to $1.50, it often costs him $1.70, and it often surprises me how a contractor keeps out of the poorhouse when he is repairing along the street car rails, where the strips are deep and it takes so much material. Now that pavements have been down in the older cities for a number of years and have passed out of the guaranty or maintenance period, so that it becomes the duty of the city officials to maintain the pavement, we find that the money set aside for that class of work is growing enormously. I will give you the figures in our own city, where possibly five years ago there was about $3,000 spent in the maintenance of our asphalt pavements, and we had something over 5,000,000 yards of asphalt at that time. The next year there was probably $10,000 spent, which really did not amount to anything. The year after that, $130,000, and the next year over $200,000. This year we have passed through a change in administration, where the city engineer knew that his office would not last and did not take any active steps toward looking after this class of work, leaving it to his successor, which, in a measure I think, was the right thing to do. As they were so long getting adjusted, there was very little work done in Kansas City; but the work is keeping and we will have it next year. In cities that have had it longer than we have, the question is a more vital one.

We have a machine that they have been pleased to name after the inventor, myself, the Lutz surface heater. This is a traction machine that can be moved over pavements and set down over the spot to be prepared, and in this machine we burn oil to heat an enormous volume of air. We found it necessary in early experiments to heat the asphaltic or bithulithic pavements, or asphaltic-concrete, or whatever other names they may have. But we found the flame was injurious to the asphalt, and in many cities in the west they have discontinued and not allowed the use of such machines as Perkins' burners, because asphalt is eminently rubber and highly inflammable, and about the quickest way to ruin asphalt pavements is to get flame on it. So we wanted to soften the asphalt pavement to remove such parts as it is necessary to remove, and to do this, we must heat it in such a way that the heat will penetrate through without overheating it. This we found we could accomplish by applying a blast of air to the pavement. It took an enormous amount of heat, and I had difficulty with mechanical engineers in various parts of the country when I took my proposition to them to have them work it out. They told me how impossible it would be to get so large a volume of air at the temperature I wanted it—anywhere from 600° to 800°. This was finally accomplished, and we have resurfaced possibly twenty to thirty miles of asphalt pavement with these machines, and have done repairing, that if the patches were put together, would add possibly eight or ten miles more. We have covered fourteen cities—Chicago, Kansas City, some work in Brooklyn, Buffalo, St. Paul, Cedar Rapids, Indianapolis, Muncie, Cincinnati, and a few other places.

You might ask what would be the cost of this class of work? I will describe how the work is done. We drop a hood, which can be of any size. We find for our purposes the best size is five feet in length and ten feet wide, covering a strip of ten feet along the street. We then blow the hot air onto the pavement, and when the pavement is softened, the workmen, with rakes and hoes, remove any part that is too high or cracked,

that is distintegrated or burned by bonfires on the street, or in any way spoiled. Then, while the material is heated, joints are cut with the hoe and new material is added immediately, just as a blacksmith would weld iron. This is raked onto the old material without any painting or anything of that sort, only the application of the new material to the old. This is tamped and smoothed and rolled to the original contour of the street.

This amount of new material varies greatly from one-quarter, or even less, to two or three inches in some very deep holes. Some of you may think a quarter or half an inch is not enough material. These extreme cases where we used very little material were cases where the engineers were anxious to learn if they could use the machine to advantage in skim patches. Skim patching by the old methods seemed to have pulled off, and did not weld. We had some cases where the pavement was soft and the sun beat upon it and melted it until it was in waves. It was a very clean pavement, where little dirt had been ground into the surface, and when this pavement was heated the material raked off wasn't to exceed an eighth or possibly one-sixteenth of an inch, and the hills were shaved off into the low places and just a little new material, just a few shovelsfull to the yard, was used to redress the street.

Every time I pass through the city where that work is done, I go to examine this spot, and none has ever peeled off. The officers say they have never touched it, nor has it had any repairs. The reason is that if the old pavement contains enough bitumen to permit of its being melted readily, if it softens easily and when it is heated you can see by the color of it that it is very black, you will know you will get a good weld, and oftentimes we have tested material taken from a street and found it as good as the new material being put down. We have resurfaced some of those streets for as low as eighteen cents a yard, which seems almost incredible, but is due to the fact that very little new material was used. We used from one inch to one and a half in Kansas City. The contractors using our machines

have taken the work as low as eighty-seven cents per square yard, have paid us our royalty, and claim to make some profit out of it. Previous to our coming they never had work done for less than $1.50, and sometimes $2.00. So in the maintenance of asphalt pavements by these heaters we have been able to save the city a half, or a little more than half, of what it used to cost them, and that will allow them to do twice as much as they used to do with the same amount of money. Perhaps in some localities, where sand and labor and materials are high priced, you cannot get the favorable conditions they have in other places. We have repaired bithulithic pavements with marvelous success, and other kinds of bituminous pavements.

I want to give you an idea of another class of work this machine will do in the near future, that will probably supersede the work of repairing asphalt pavements. We have in our city a great amount of old brick, cobble and other sorts of hard pavements. On streets where the city desires to put down a more modern pavement of some kind, we can take this machine and heat the old pavement by blowing this blast on it, which in nowise injures it. We have heated thousands of yards of granite and brick pavement and never cracked a bit of brick, because the heat is applied so gently it will not injure it as the flame would. Then when it is heated we were able to mop it or paint it as you would a tar roof, and then leave the pavement until that material had cooled or chilled some, and then dump a mixture of whatever surface material was desired, which would adhere. We have later cut through some of this, and have found that the top of the rock on which the pavement was laid will break off before the asphalt will be separated from it. We have done much of this work in Chicago, and much more work has been laid out.

I want to speak for a moment about a mixing plant that we feel we have made a great revolution in. There are many things in mixing plants that make our pavements get bad. I would like to go into detail and tell you why asphalt pavements deteriorate, but I will not encroach upon your time, but in

brief, I will state this: I have found from actual experience and observation that our asphalt is often burned in the melting kettles; it is sometimes ruined at the refinery, and in most of our modern plants where oil is used as a means for softening the asphalt so that it will not be affected by frost, we find that a settling will take place in the kettle, unless agitated, a separation of the asphalt and oils, showing that there is no chemical union between oil and asphalt, that the union is purely mechanical, and this union does not take place unless it is agitated. We have even found that the separation will take place in the pipes leading from the kettles where they have waited for the wagons to load up. In working out the problem we have built and operated a mixing plant in which it is impossible to burn the asphalts; impossible for the asphalts and oils to separate in any way after they have been once joined together, or to overheat the sand or burn any part of the mixture. In other words, we have reduced the science of mixing asphalt pavement to the same level as that of mixing concrete. We know how easy it is to mix concrete, and the mystery that has enshrouded asphalt for many years is gradually disappearing. We accomplished this result by taking a very large drum capable of holding an entire wagonload of material. The material can be either weighed or measured while cold, both the sand, or whatever you choose to use, broken stone or sand, or the binder alone if you please. It is taken up in chunks about the size of one's fist and put into a large hopper over the drum. The drum is opened and the entire batch dropped into this drum, just like a Ransom concrete mixer, if you are familiar with them, although that construction will not entirely work out our problem; we had to make a number of very vital changes, but it is similar to the Ransom concrete mixer. The idea of the drum is to carry the material up and gradually distribute it down or drop it, letting it filter down through a blast of hot air blown through the drum. This blast of hot air is produced in about the same manner that we produce it in heating machines with oil. This

blast is blown through the drum. The materials falling through the blast are dried and heated, the asphalt is melted and the mixing is carried on, all at one and the same time. We get no odors from the plant, no dust leaving the drum so that you have to add more to it, as is the case with sand dryers. When this material is mixed for from three to seven minutes, according to the material and quantity, it is dumped into a wagon, one entire batch instead of six, seven or eight, as is the practice where we mix about 1,000 pounds to the batch.

This plant was in operation awhile in Kansas City before being shipped to Texas, and the first day's work was very interesting. The street car company, after having quite a war with one of the old asphalt companies about repairing their part of the work between the tracks and outside of the rails, decided to do this work themselves. They gathered up five tons of old material taken from streets in times past in their own construction work, and the first two days our plant ran, while waiting for the parties to use it who wanted it, we broke up this old material into pieces the size of your double fist and threw it into this drum. A great deal of the binder was attached to the old material, and this was used because it didn't make much difference what they were using. This material was run through the drum, and to some of it, when it looked dry, they added about a bag of asphalt to a wagonload of material, and you would be surprised at the nature of this material when it came out of the drum. It looked like, and was a perfect mixture, and that material on the street has given wonderful results. Some of you may have an old asphalt dump near your city and may have a chance to utilize that to make binder or a base for some kind of pavement, if for no other purpose.

I understand that the Germans like to cook their materials, they are not satisfied with mixing it; and I have seen pavements that have been cooked and laid with a hand trowel, as you lay cement sidewalks. At the time I doubted very much as to the life of such a pavement, but I have since visited these

pavements and have failed to find marks of deterioration, any cracks or other defects. I have been surprised with the construction. In our experiments we dumped out half a batch from the machine and left the balance to see what effect overheating would have on it, whether it would injure it. We left it in fifteen minutes when it was at a temperature of 365°. (With the class of Texas asphalt with which we were making the test that temperature was necessary in order to have a perfect plastic material.) We found after cooking this material fifteen minutes that it had stiffened up a little, but did not get hard; it seemed a little stiffer to work, like dough that had a little more flour in it. We took part of it and left a quarter of it in the drum and revolved that for fifteen minutes longer, leaving it half an hour over time, and we found that it turned out material that was almost similar to concrete. It had the toughness of concrete; it looked like wonderful building material, and the large volume of air passing through there had sufficiently oxidized it to make it tough without being brittle, which condition we could not arrive at in any other way of doing this work. It has shown us the way to make bituminous concrete, if necessary, for building dykes or retaining walls or anything of the kind. There have been so many uses to which we have put both the heater and the mixing plant that it would take me hours to tell you of the work, and I will close by thanking you for your kind attention.

DISCUSSION.

MR. KINGSLEY: Is this mixer you describe similar to what has been advertised as the Blake concrete mixer?

MR. LUTZ: I would like to state that Mr. Blake and I are the joint inventors of this machine.

MR. KINGSLEY: My reason for asking was that a certain representative of the Texas Company was in my office some three weeks ago and he was discussing this kind of bituminous pavement mixed with Texas material, and he mentioned the Blake mixer that had been shipped to them, stating they had been compelled to discard it. I would like to know whether that is true or not, and if true, what was their reason for discarding this mixer; why it wasn't satisfactory?

MR. LUTZ: The last time I met the general manager of the Texas Company in his office in New York City I asked him as to that very statement you have just made, and he said that if anything of the kind had ever transpired, he would have known something of it. As a matter of fact, he said he was getting reports daily showing the amount of work they were doing with that plant I had designed and constructed, and he said they not only had good results from it, but they far exceeded the record we made at Kansas City with it. I told him somebody said the material was not satisfactory, and he said he had never heard such a complaint from it. There has perhaps been an incident connected with it that may have been misconstrued. Mr. Blake had some kind of a business arrangement with the Texas Company and they rebuilt two machines Mr. Blake had at Sharon, Pa., and put on them drums to accomplish the same result, but not such as we first designed, and they were unable to get the results. Mr. Blake called on me in Kansas City and wanted to know if I could go to Sharon, Pa., and reconstruct the drum, because they didn't get good results. I told him I would do so. Later I learned that their negotiations with Mr. Blake were declared off, the time was fulfilled, and they never finished their original agreement.

So far as the machines I built at Kansas City and which the Texas Company used in Texas at various points are concerned, they have been an absolute success, because our master mechanic returned from there after they had finished the work or after a certain season, and brought me the reports showing that the work was properly and perfectly done.

MR. KINGSLEY: I did not ask that in criticism, but simply because this gentleman said they had an old Blake mixer shipped them, and they had attempted to use it but could not. He claimed for some reason they could not get and maintain a high degree of heat.

MR. LUTZ: That was their trouble at Sharon. I had nothing to do with those plants.

MR. KINGSLEY: You do not know whether that was the plant you shipped them?

MR. LUTZ: It could not have been. I am quite sure it was the plant they used at Sharon, Pa., or tried to use, and did not get good results.

MR. HOWARD: As the flame goes into this drum, doesn't it touch the material?

MR. LUTZ: No flame enters the drum.

MR. HOWARD: Didn't these machines at first have the flame through the center?

MR. LUTZ: No, sir, the furnace is separate and apart from the drum.

MR. HOWARD: The Asphalt Company built quite a number on that principle, and their plant was afterwards sold and the company closed up, but as to the details and mechanical arrangement I know nothing about it.

BUSINESS PROCEEDINGS

OF THE

FIFTEENTH ANNUAL CONVENTION

OF THE

American Society of Municipal Improvements

TUESDAY, OCTOBER 20, 1908.

AFTERNOON SESSION.

The Fifteenth Annual Convention of THE AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS was called to order in the Hotel Dennis, Atlantic City, New Jersey, at 2:30 P. M., October 20th, 1908.

THE PRESIDENT: Ladies and Gentlemen of the American Society of Municipal Improvements—and when I say "Ladies" of the Society, I say it advisedly. During the past ten years we have heard much about the "man behind the gun," and his power to preserve our foreign relations. I want you to understand that I have great respect for the woman behind the man, and her power to preserve our domestic relations. It has been my good fortune to meet many of the ladies who control the active members of our Society, and I know whereof I speak. We have come here today to this city by the sea for our annual meeting. I shall not attempt to say anything about it, because there are gentlemen here who know so much more than I do that it would be useless. I now have the pleasure of introducing to you the Honorable Franklin P. Stoy, Mayor of Atlantic City, New Jersey.

MR. STOY: Mr. President, Ladies and Members of this Association: I assure you that this is a very great privilege to

be permitted to come to your meeting and offer you the right hand of fellowship, and so welcome you as our guests. I do not know of any set of men who live and do business in the United States that we welcome more heartily than we do you here today. Municipal improvement is one thing that is uppermost in our minds in Atlantic City, and has been for the last twenty years, and when it comes today to bidding you welcome to this town, I feel that it is a very great and responsible duty. Let me say to you, while we bid you welcome, we extend to you the freedom of the city, and we hope that during your short stay with us you will have an opportunity to see many things perhaps that are done in the way of municipal improvements in a seaside resort. We are not altogether in the humor to say that we are first class in everything, but I must say for the city government that we are striving and are making great headway to become a first class city, at least a first class seaside resort, and with your presence here and what we can learn from such an association as this we are especially favored. I assure you it is a great thing for us, and I hope those who have the municipal affairs much at heart will converse with you during your stay here.

I was a little amused at your President's reference to the ladies of this association. Let me say to him and the convention that in my experience of perhaps fifty or seventy-five of these occasions in a year, I have never yet seen one complete without the ladies. I have often said that the ladies follow the members of these institutions until I have become impressed by the remarks of the president of one of the associations that met here this month, that it wasn't so in his case; that he had been married thirty or forty years, and he had been following his wife ever since their marriage. Therefore, I think the ladies have set the pace, and the members have come here today to have their little institution and meet together, and with the ladies as your caretakers, we hope you are going to have a convention that you will remember. I regret very much, Mr. President, from what I know, that a

number of your members are not present. However, you may extend the same welcome to them that I have extended to you. Say to them that the freedom of the city is yours, and if there is anything in the Department of Public Safety that you require, I hope you will make it known before you leave. I thank you for your attention, and I hope, Mr. President, that you will have a very successful meeting.

The President: In behalf of the American Society of Municipal Improvements, I thank you for your cordial welcome. At the same time that I thank you for the freedom of your city, I want to tell you that you are safe in giving us this freedom, because I wish to call your attention to the fact that we came here on Monday and we will leave before Saturday.

This Society, Mayor Stoy, is made up of public officials from the different cities in this country and in Canada. We have on our roster members from every State in the Union with the exception of eight, and from nearly every Province in Canada. The objects of the Association are not wholly for benefit, but are also social, and while it may seem paradoxical, we believe that the social benefits we receive are actually physical benefits. When in Detroit a year ago we decided to come to Atlantic City, we broke a precedent, a precedent that had been established at the beginning of the Society, namely, not to go to any city where we did not have a resident member. We had, however, all of us heard of the fame of Atlantic City, and some of us had been here. We thought, therefore, that because of the attractions of the seaside and of what we knew and our families knew of Atlantic City, that your city would have great attraction, and that we could in this way bring here a larger number of the controlling members of the household than if we went to some other place, and we wished to have those members here in order that they might see that when we speak of going to Rochester or Buffalo, or Atlantic City to attend these meetings, it was not like going out to the usual club meeting at home, but that we did come here for real work and real benefit. We have members who are experts in their different

lines, and while we do expect to derive benefit ourselves from these meetings, we are also eager to give benefit, if possible, to the city in which we meet. If, therefore, we can do anything of this kind for the people of Atlantic City, be they officials or laymen, we shall be very glad to do it, and I hope that as we have lately taken in some members from this city, they will receive benefit from our meetings in after years, and that when we come to Atlantic City again, as I hope we may, we may have a larger membership.

THE PRESIDENT: The next thing in order is the roll call, and if there is no objection, it will be omitted.

(*No objection was made.*)

THE PRESIDENT: Next comes the reading of minutes of the last meeting. As these minutes have been printed and distributed among the different members, they will not be read unless there is a call for them.

(*Reading of minutes omitted.*)

The next in order is the consideration of applications for membership.

THE SECRETARY: I have a list of the applicants here, and as the reading over of a series of names is frequently tedious, both for the reader and the listener, and as it does not seem advisable to pass on the names without reading them, I have arranged them geographically, so the members from any section will be able to tell beforehand whether they will find anything interesting in the list or not. The applicants are as follows:

APPLICANTS FOR MEMBERSHIP.

CORPORATE.

Alabama—

Birmingham........................Meriwether, B. B.
Birmingham........................Nicholson, M.
Montgomery........................Gilchrist, A. R.

Arkansas—

Hot Springs........................Ellsworth, Frank V. P.
Little Rock........................Kingsley, Edgar A.

Applicants for Membership—(Continued).

California—	
Berkeley	McClure, W. F.
Delaware—	
Wilmington	Taylor, Alex. J.
Wilmington	Horrigan, W. J.
Florida—	
Daytona	Rogers, D. D.
Georgia—	
Albany	Edgerly, R. J.
Atlanta	Collier, Henry L.
Atlanta	Norcross, P. H.
Brunswick	High, Joe B.
Columbus	Browne, Rhodes
Illinois—	
Chicago	Hittell, John B.
Chicago	White, Linn
Granite City	Hall, Edmund
Moline	Anderson, Clark G.
Indiana—	
Terre Haute	Schmidt, E. B.
Iowa—	
Des Moines	Wise, W. W.
Massachusetts—	
Beverly	Whitney, Harrie L.
Boston	Atwood, Joshua
Michigan—	
Grand Rapids	Christ, Edward H.
Missouri—	
Lexington	Wilson, Jos. A.
Montana—	
Billings	Gerharz, Henry
Butte	Leggat, Alex.
New Hampshire—	
Concord	Clark, Alfred
New Jersey—	
Atlantic City	Hackney, John W.
Atlantic City	Heston, A. M.
Hoboken	Smith, Eugene
Montclair	Owen, Kenneth D.
Newark	Gardner, Geo. H.
Newark	Morris, J. B.
Newark	Reynolds, A. M.
Phillipsburg	Howell, R. P.
Rutherford	Watson, Robt. M.
Ridgewood	Hanks, John T.
South Orange	Halsey, Edmund R.
Somerville	Doughty, Joshua, Jr.

Applicants for Membership—(Continued).

New York—	
Albany	Greenalch, Wallace
Brooklyn	Hammond, Geo. T.
Corning	Canfield, Robt. H.
Elmira	Brown, Thurber A.
New York	Endemann, Herman K.
New York	Smith, Francis P.
New York	Tribus, L. L.
New York	Parmley, W. C.
New York	Hillyer, Wm. R.
Poughkeepsie	Ridgway, Robt.
Rochester	Grant, J. H.
Syracuse	Allen, H. C.
Troy	Grimes, E. L.
Yonkers	Cooper, Sam'l L.
North Carolina—	
Asheville	Lee, B. M.
Charlotte	Firth, Jos.
Winston	Ambler, John N.
Ohio—	
Cleveland	Hoffman, Robt.
Columbus	Maetzel, Henry
Sandusky	King, Clifford M.
Oklahoma—	
Hobart	Noble, O. E.
Shawnee	Brown, Frank D.
Pennsylvania—	
Carlisle	Bingham, Clarence A.
Norristown	Corson, S. Cameron
Pittsburg	Reppert, Chas. M.
Pittsburg	Taylor, C. F.
Pittsburg	Sprague, N. S.
Reading	Beard, E. H.
Titusville	Holstein, H. A.
Wilkes-Barre	Finch, B. K.
Wilkes-Barre	Barrett, Thos. A.
Williamsport	Fisher, J. F.
South Carolina—	
Charleston	Dingle, Jas. H.
Columbia	Shand, Gadsden E.
Greenville	Neves, Wm. D.
South Dakota—	
Aberdeen	Washburn, D. Cuyler
Tennessee—	
Jackson	Thompson, Atwell
Johnson City	Wilson, L. N., Jr.
Knoxville	Newton, Sam'l D.
Memphis	Weatherford, J. H.
Nashville	Southgate, Wm. W.
Texas—	
Austin	Iredell, Geo. S.
Dallas	Erwin, M. C.
Dallas	Wadsworth, Chas. S.
Dallas	Preston, J. M.

APPLICANTS FOR MEMBERSHIP—(Continued).

Utah—
Ogden..............................Parker, A. F.
Provo..............................Jacob, Elmer A.
Salt Lake City....................Kelsey, Louis C.

Virginia—
Lynchburg..........................Shaner, H. L.

Wisconsin—
Green Bay..........................Reed, W. W.
Neenah.............................Sweet, H. L.
Racine.............................Connolly, P. H.
Watertown..........................Parsons, E. B.

Canada—
Toronto............................Ward, J. J.

ASSOCIATE.

Connecticut—
New Haven..........................Magill, Claude A.

Illinois—
Chicago............................Standard Asphalt & Rubber Co.
Chicago............................Rudolph S. Blome Co.

Minnesota—
Minneapolis........................Boyce, C. F.
Minneapolis........................Kettle River Quarries Co.

Missouri—
Kansas City........................Lutz, G. H.

New Jersey—
Atlantic City......................Cherry, Wm. I.
Morristown.........................Loud, H. S.
Newark.............................Hoyt, Ralph
Newark.............................Gilligan, Hugh F.
Newark.............................Shreffler, J. M.

New York—
New York...........................Harris, Walter B.
New York...........................Imperial Road Company.
New York...........................Power Specialty Co.
New York...........................Farr, Leslie B.
New York...........................Medill, Wm. W.
New York...........................Meriwether, Coleman
New York...........................Municipal Journal and Engineer.

Pennsylvania—
Philadelphia.......................Jackson, Newton
Philadelphia.......................Miner, H. A.

Tennessee—
Nashville..........................Johnson, Alfred H.

Wisconsin
Milwaukee..........................Kindling Machinery Co.

(*The above list includes those elected later during the convention.*)

THE PRESIDENT: What action will you take on these names?

MR. OWEN: I move that the Secretary be instructed to cast the vote of the Society for the gentlemen whose names have been read.

(*Motion duly seconded, and carried*)

(*The Secretary casts the vote of the Society for these members, and they are declared elected members of the Society.*)

ADDRESS OF THE PRESIDENT.

According to our Constitution, it is incumbent upon the President to deliver an address at the Annual Meeting. In the past this address has sometimes taken the part of informing the Society what it had been doing, what it was then doing, or what it ought to do in the future. It has seemed best, therefore, at this meeting, to talk to you somewhat upon the combination of all these ideas or the importance of the work that is constantly being done by members of this Society. And, as practically all physical improvements in the different cities are being performed under the direction of civil engineers, a brief resume of their work may not be out of order.

One hundred years ago a few civil engineers of this country were engaged in building and maintaining canals and highway bridges. Fifty years later their number had vastly increased, and their work changed to that attendant on the construction of steam railroads, which the previous quarter of a century had seen introduced and attain a wonderful growth. At this time also a few engineers were engaged at intervals on municipal work, but not to such an extent that they could be termed Municipal Engineers. Their municipal business was principally looking after the installation of pavements, sewers and waterworks.

At the present time, how different the conditions! There are thousands of engineers whose entire professional life has been given up to municipal work, and their field involves not only the above mentioned subjects, but a knowledge of elec-

tricity for lighting and power; gas for lighting; the equipment and operation of railroads; the laying out of transportation lines; steel and concrete construction work; hygiene; all kinds of mechanical engineering, etc. These qualifications need not be, and very seldom are, all found in one man, but every municipality of great magnitude constantly requires advice upon the above subjects. If it has not such experts in its employ, it must engage them for special reports. In short, with the present large number of varied public service corporations operating in all our cities, each city must know, with approximate accuracy, all the conditions involved in the operation of each, so as to impose upon all suitable restrictions and regulations, in connection both with the granting of a franchise and with conducting their business after final completion, and it looks to its experts for this advice and information. In other words, the municipal engineer should understand the business of all corporations, as well as the special expert employed by each one.

It is probably a fact that of the engineers of the country engaged in active practice, fully one-half are employed on municipal work, and undoubtedly so if there are included those who, while not employed by the municipalities direct, are nevertheless doing true municipal work for corporations operating in cities.

The reasons for this change in engineering work are not hard to find.

In a country so large as ours, and which was in so crude a state a century ago, where its products, both agricultural and mineral, were so varied and so scattered, railroad construction was absolutely necessary for its development, and to the advent of steam railroads in the first half of the nineteenth century, rather than to any special ability of our forbears, can be attributed the wonderful growth of the United States. But railroads could not exist without people living along their lines, to furnish them with business. With transportation facilities came the people, and they, in turn, brought new railroads, till now we see the country gridironed with transpor-

tation routes to such an extent that it is probable that many years will elapse before any more extensive new lines will be laid out; and the principal railroad work of the near future, undoubtedly, will be the regrading and re-aligning of old roads, the removing of old crossings and the improving of their terminal facilities.

But cities have kept on increasing, both in number and size, so that at the present time a large portion of our population is living in what can be called urban districts. In the State of New York, for instance, about 75 per cent. of the people live in cities of more than 8,000, and 65 per cent. in cities of more than 25,000 inhabitants. These proportions will not hold good in other states, but they show the natural tendency of the human race to gregarize.

This growth of the cities, together with the urban needs of the twentieth century civilization, has created a vast demand for municipal engineers, and the engineering schools of the country have had difficulty during the past ten years in supplying the demand.

It has been said that the men engaged in municipal work fifty years ago had charge of the construction of pavements, sewers and water-works. But how crude their efforts as compared with that of today! The standard pavement was then macadam and cobblestone, constructed primarily to sustain traffic. Today the engineer in charge of pavements must construct a roadway that will not only be satisfactory to traffic, but it must be easily cleaned, so as to be sanitary; it must be free from noise, otherwise it will interfere with schools, hospitals and churches, as well as with the business of merchants along its line; and it must be cheap enough to be within the reach of cities of moderate means.

The sewerage engineer of fifty years ago built sewers to carry off the normal sewage of a community and delivered it into the nearest stream. Today cities are in existence and constantly coming into existence so remote from streams or tidal waters that it is impracticable to thus dispose of the

sewage, and it must, therefore, be so treated and disposed of as not to be a nuisance or detrimental to health. In many cities situated on large rivers the volume and character of the sewage has so changed on account of the increase in population and the different manufacturies that the pollution of the stream waters has become a serious matter. A specific instance of this is New York Bay and the Hudson River, where a special commission is at present employed investigating the conditions now existing there.

Fifty years ago the hydraulic engineer brought water from some convenient stream or lake and distributed it in the various cities in quantities sufficient for domestic use and fire protection for buildings of four or five stories. Today he must furnish fire protection for buildings thirty, forty, and even fifty stories high; and, in addition to providing a sufficient supply, he is constantly working to keep it pure and wholesome, as he finds that villages and cities have sprung up around the sources of his original supply. With the enormous growth of our cities, he must keep his eyes on the future, so that no shortage of water shall ever menace his city. This increase in growth causes the cost of supplying water to increase per capita almost in a geometrical ratio. A striking instance of this at the present can be seen in New York City, where plans have been adopted and work begun on a system for an additional supply, involving an expenditure of over $200,000,000, or about $45 for each inhabitant of the city.

Among the great municipal undertakings of the last few years can be cited the Municipal Drainage Canal of Chicago, the Subway and Metropolitan Water Supply of Boston, the great water filters of Philadelphia, and the subway and water supply just alluded to in New York City. All over the country, in the smaller municipalities, work of comparatively the same magnitude is constantly being carried on.

In considering physical improvements in cities, there must not be forgotten another class of men who are important factors in all municipal work; namely, the contractors.

The time has been when if a spirit of friendliness existed between engineers and contractors, it was considered as evidence that a spirit of collusion between the two also existed. Whether this be false or true you all know. The good contractor is an asset of the good engineer and the converse is also true. The engineer must depend upon the success of his work for his reputation and the contractor is working for profit. The good contractor, however, figures upon doing his work well and for a fair price and it is for his interest to have an engineer who understands his wórk and draws up his plans and specifications intelligently. The province of the engineer is first to see that the spirit of the contract is carried out. He must get good work at all hazards. If, then, in the conduct of the work the contractor can be accommodated, there is no reason why he should not be, and allowed to carry on his contract in a way that is most advantageous to him, always assuming that the interests of the city do not suffer. There is no reason why the engineer and contractor should not work in harmony and produce good results.

If, however, the engineer's plans are faulty and he attempts to cover up his mistakes at the expense of the contractor, or if the contractor finds that he has failed to properly estimate the cost of the work and so has made the contract price too small and tried to even up by slighting his work, trouble is bound to ensue.

Although much has been said about the physical work of the Society, it must not be understood that that is all that the Society undertakes. All cities are governed by certain laws, rules and regulations, and upon the character of these depends in a great measure the success of the official and the prosperity of the city.

Cities must have laws and all municipal officers must be bound by them. But these laws should be permissive as well as restrictive. The ambitious official wants to know how he can perform a certain task, not why he cannot.

It has been said that the laws of Massachusetts have been drawn with the idea that all men are honest, and those of New York with the idea that all men are dishonest. The one hypothesis is probably as true as the other. Human nature is practically the same whether located upon Massachusetts Bay or the Hudson River, and the people of Boston are apparently just as anxious to capture the almighty dollar as those of New York, and perhaps even more anxious to retain it. But the idea is that men should be put into office and given authority to act and then held responsible for their actions. Authority and responsibility—those are the two key words of the situation. If you wish responsibility you must give authority.

From the above two words there naturally comes a third—accountability. Give an official authority, hold him responsible and make him accountable for his acts and if there is any ability in the man, good results are bound to come. Do not, however, expect perfection. Errors of judgment will always be made. He who does much is bound to make mistakes. But dishonest acts should never be condoned.

It is pleasing to note that an effort is being made by some of our municipalities to get out of the path in which we have been traveling and form new schemes of government. Galveston is controlled by a small board, each individual being given certain functions to perform and expected to perform them well. Here are authority and responsibility. Des Moines has adopted somewhat the same plan but seeks to carry it farther by making the officials directly accountable to the electors for any mistake made in office. Here are found authority, responsibility and accountability.

The chief requisite of any city charter is to allow the placing of the responsibility for any defect upon one man. Let it be the Mayor, Director of Public Works, or whoever it may be, but make it possible to find one responsible man and let him locate the individual subordinate who is really to blame. In this way it is easy to correct evils, locate and remove delinquent employes, and thus improve the system. In New York

City today several officials and commissions have certain control over the streets, and without harmonious co-operation it would be impossible to get anything like decent results.

We are told that in the municipalities across the water they do things differently and much better than we. They ought to; they have been working at it long enough. But testimony, given by technical men who have visited the old country recently and who have been competent to investigate the matter, would seem to indicate that where conditions are the same, much the same results are obtained. You can rest assured that in any city where a single paving stone has not been taken up in years (and we are told that seriously) there cannot be much change going on. Your President said a short time ago to one of the most prominent civil engineers of New York: "I do not know as New York will ever be completed," and he replied: "No, and it would be a sorry day for the city if it ever should." There is a great deal in that.

When, as is being done in New York at the present time, a fifteen-story building is being torn down to be replaced with one of thirty-five, and plans for another of sixty stories have already been filed and approved—when such buildings with their attendant subsurface construction are constantly being erected, when it is necessary to build subways to carry the people to and from them—is it strange that our streets should be torn up? It is deplorable but necessary. They tell us we should have underground conduits, but who in New York or any other large city twenty-five years ago had the foresight to have planned such conduits, either their capacity or location? The thing to do today is to allow necessary street openings but reduce their number to a minimum and have them closed as quickly as possible until the real problem is settled.

I believe that we should study the old cities of Europe, their customs and their laws, both past and present, for we can learn by mistakes as well as successes, and we have much to learn. We should study them so that we may apply and modify them to suit conditions in American cities. When that has been

accomplished, and when some of the existing fallacious theories have been exploded, then I believe we shall see a city charter modeled on the best experience of the past adapted to modern needs and modern progression, a charter that will be the peer of that of any city of Europe, a charter that will provide for administrative officials who will have both authority and responsibility, and perhaps accountability, and for executive officials who shall be trained for their work and who shall serve during good behavior, and the result will be a city government and a city itself, giving due consideration to the beautiful as well as the practical, governed according to American conditions, that will be without a peer in the entire world.

THE PRESIDENT: We will now have the report of the Secretary.

REPORT OF THE SECRETARY FOR THE YEAR 1907-1908.

NEW YORK, Oct. 19, 1908.

American Society of Municipal Improvements.

GENTLEMEN: I beg to submit herewith my report for the year ending October 17, 1908.

The receipts of the Society have been as follows:

Dues of present members	$769 00
Advance dues from applicants	305 00
Advertisements in Proceedings	204 70
Sale of Proceedings	32 75
Total	$1,311 45

These amounts were paid over to the Treasurer, as follows:

Oct.	6 (by ex-Secretary Tillson)	$175 00	April	6	77 00
Nov.	12	20 00	May	23	35 00
	18	45 00	June	18	105 00
	30	80 00	Aug.	18	57 00
Dec.	9	45 00	Sept.	19	15 00
Jan.	2	45 00	Oct.	10	320 75
Feb.	5	40 00		16	70 00
March	2	65 00			
	4	7 00			
	19	109 70			$1,311 45

The expenses of the Secretary's office during the year have been as follows:

In connection with Proceedings	$10 65
Printing letter heads, bill heads, etc	26 70
Duplicate letters	23 60
Postage	126 62
Office assistant	39 20
In connection with 1908 convention	5 00
Miscellaneous	6 55
	$238 32

Classifying the total expenditures of the Society for the year under several heads, we find these to have been as follows:

1907 Convention stenographer		$54 50
1907 Proceedings—Engravings	$34 70	
Printing	561 28	
Distributing, etc.	10 65	
		606 63
Secretary's salary for 1906-7 and 1907-8		400 00
Clearing House—Stenographer	$19 20	
Duplicate letters	23, 60	
Postage	26 62	
		69 42
Publicity, office expenses		140 00
General office expenses		49 25
1908 Convention—Badges	$58 80	
Programs	37 75	
Miscellaneous	5 00	
		101 55
Total		$1,421 35

Publicity Fund and Clearing House.

It will be remembered that the Society, at the last convention, placed at the disposal of the Secretary's office the sum of $500 for the operation of a clearing house of municipal information and the increase of our membership. The above statement shows $209.42 used for that purpose; but in addition, the distribution of a copy of the Proceedings to every city engineer in the United States of towns of more than 10,000 population, and many smaller ones, cost about $150 additional, making about $360.00 in all. In connection with this work between 4,000 and 5,000 duplicate letters and application blanks were sent out, and about 1,500 personal letters written.

About twenty questions were received and answered by the clearing house, most of them involving the sending of circular letters to from

50 to 300 city officials. The replies and data thus obtained are kept on file for reference should similar questions be asked again. There was evident a growing interest in and use of this department, but it should be used more generally by members. I would suggest that the various committees could employ it to advantage in obtaining information in connection with their work. Among other facilities, the department has access, through the courtesy of the paper of which I am editor, to a list of the city officials of all cities of more than 3,000 population, and many smaller ones, kept as nearly up to date as is practicable. I believe this feature of the Society's activity has done much to advertise it, as well as to benefit its members.

MEMBERSHIP.

		Corporate		Associate		Total
At the time of the last report the membership was as follows		143		53		196
On October 3d there were elected		13		3		16
Making a total of		156		56		212
During the past year there have resigned	7		14		21	
And been dropped for non-payment of dues	24		8		32	
A total loss of	—	31	—	22		53
Leaving at present		125		34		159

Especial attention is called to the large number which have been dropped for non-payment of dues. The Constitution provides that, "Any member who shall be in arrears for more than one year's dues shall be considered as no longer a member of this Society, and his name shall be discontinued from the roll by the Secretary." All who are listed as being dropped, are, with the beginning of this convention, two years in arrears. I am convinced that many are merely remiss, and have no wish to abandon their membership in the Society; although three requests for payment were sent them during the year. I would suggest that authority be granted by the Society to retain their names upon the membership roll until one more effort be made to bring them into regular standing by the collection of arrears.

The members have responded quite generally to requests of the clearing house for information, and have made the success of this possible. The members and officials have displayed great interest in the growth and welfare of the Society, of which our record-breaking list of new members is the proof and direct result.

Respectfully submitted,

A. PRESCOTT FOLWELL,

Secretary.

Account examined and found correct.

A. F. EGGERS,

Chairman Finance Committee.

THE PRESIDENT: The financial part of this report is in the hands of the Finance Committee.

MR. HOWARD: I was disappointed to note that the constitution reads "shall be suspended." In all of our clubs and societies we have the word "may," and later in the convention I shall move that the constitution be changed to read "may" instead of "shall," and furthermore, to move the reinstatement of those members that have failed to pay their dues, and to leave that in the hands of the Secretary under the form of "may be suspended." That will give him time to do as he suggests.

THE PRESIDENT: If there is no objection, this report will be accepted.

(*No objection.*)

THE PRESIDENT: The Treasurer will now make his report.

ANNUAL REPORT OF TREASURER.

WILMINGTON, DEL., Oct. 17, 1908.

American Society of Municipal Improvements.

GENTLEMEN: I submit herewith the report of the Treasurer for the year ending October 17, 1908:

		RECEIPTS.		
1907.				
Oct.	1	Balance	$715 14	
	9	Received from G. W. Tillson, Secretary....	175 00	
Nov.	13	Received from A. P. Folwell, Secretary....	20 00	
	19	Received from A. P. Folwell, Secretary....	45 00	
Dec.	3	Received from A. P. Folwell, Secretary....	75 00	
	10	Received from A. P. Folwell, Secretary....	50 00	
1908.				
Jan.	3	Received from A. P. Folwell, Secretary....	45 00	
Feb.	6	Received from A. P. Folwell, Secretary....	40 00	
Mch.	3	Received from A. P. Folwell, Secretary....	65 00	
	5	Received from A. P. Folwell, Secretary....	7 00	
	20	Received from A. P. Folwell, Secretary....	109 70	
April	8	Received from A. P. Folwell, Secretary....	77 00	
May	25	Received from A. P. Folwell, Secretary....	35 00	
June	19	Received from A. P. Folwell, Secretary....	105 00	
Aug.	20	Received from A. P. Folwell, Secretary....	57 00	
Sept.	21	Received from A. P. Folwell, Secretary....	15 00	
Oct.	7	Received from A. P. Folwell, Secretary....	320 75	
	17	Received from A. P. Folwell, Secretary....	70 00	
				$2,026 59

DISBURSEMENTS.

1907.			
Oct. 9	G. W. Tillson, services	$200 00	
Nov. 14	Central Law Reporting Co., reporting convention	54 50	
Dec. 12	Electric City Engraving Co., plates	23 80	
1908.			
Feb. 7	Electric City Engraving Co	10 90	
Mch. 30	S. E. Tate Printing Co., printing annual report	561 28	
May 27	F. F. Lisiecki, printing	36 00	
Oct. 10	Dieges & Clust, badges	58 80	
	A. P. Folwell, services	200 00	
	A. P. Folwell, expenses	238 32	
14	F. F. Lisiecki, printing	27 50	
16	F. F. Lisiecki, printing	10 25	
			$1,421 35
	Balance at this date		605 24
			$2,026 59

Respectfully,

L. V. CHRISTY,

Treasurer.

Examined and found correct.

A. F. EGGERS,

Chairman Finance Committee.

THE PRESIDENT: If there is no objection, this report will be received and submitted to the Finance Committee.

(*No objection.*)

THE PRESIDENT: The next in order is the report of the Executive Committee, but this committee has no report to make this time. Next comes report of Finance Committee, and this report will be given later in the convention.

Is there any miscellaneous business?

THE SECRETARY: A member of the Executive Committee wishes to present an amendment to the constitution in connection with fees and dues. Article III, entitled "Fees and Dues," has but one section, namely, "Each corporate member shall pay $5.00 per annum, and each associate member shall pay $10.00 per annum." The amendment is to change this by the insertion of the clause "except that if more than one representative of a given company be members, one shall pay dues of $10.00 and the others $5.00 each."

There are quite a number of business corporations in the country which have more than one member in our Society; some have two or three or even four members, and it does not seem necessary, or, in fact, desirable that each one of those should be required to pay $10.00. The object of this amendment, then, is to provide that the first one who enters shall pay $10.00, or that his company shall pay $10.00, and if any other payments for members are made by that company, those additional members shall pay only $5.00 each.

THE PRESIDENT: This is the formal notice of amendment, as required by the constitution, and the matter will be taken up tomorrow or Thursday. Major Howard will please put his amendment also in writing, and hand the same to the Secretary.

We will now have the report of the Committee on Municipal Data and Statistics, by Mr. J. W. Howard, Chairman, New York City. (See page 34.)

THE PRESIDENT: We will next have a paper on "Municipal Accounts in the Abstract," by Mr. A. M. Heston, City Comptroller, Atlantic City, New Jersey. (See page 40.)

THE PRESIDENT: This paper is now open to discussion or questions.

If there are no questions, that will be all for the afternoon, and I will entertain a motion to adjourn until 8 o'clock this evening.

(*Motion to adjourn moved, seconded, and carried.*)

EVENING SESSION.

The second session of the convention was called to order by the President at 8:05 P. M.

THE PRESIDENT: The first thing on our program this evening is the report of the Committee on Electric Street Lighting. Mr. Weissleder, however, is not present, nor has any report been sent.

We will now have the report of the Committee on Sewerage and Sanitation, read by Mr. E. S. Rankin, Chairman of the Committee. (See page 62.)

THE PRESIDENT: The next paper is one entitled "Tight Joints in Pipe Sewers," by Benjamin E. Briggs. (See page 106.)

THE PRESIDENT: If there is no further discussion, we will proceed to our next paper, "The Construction of a Reinforced Concrete Intercepting Sewer," by Alexander J. Taylor, Engineer in Charge of Sewers, Wilmington, Delaware. (See page 112.)

THE PRESIDENT: The next thing on our program will be a paper on "Mosquito Extermination," by Prof. John B. Smith, State Entomologist of New Jersey. This talk will be illustrated by lantern slides. (See page 123.)

THE PRESIDENT: This closes our program for tonight, and if there is nothing further to come before us, the chair will declare the meeting adjourned. We should try to be here promptly in the morning, for there is a long program before us.

(*Adjournment to meet Wednesday, October 21st, at 9:30 A. M.*)

WEDNESDAY, OCTOBER 21.

MORNING SESSION.

The third session of the convention was called to order by the President at 9:45 o'clock A. M., Wednesday, October 21st, 1908.

THE PRESIDENT: The first thing on the program this morning will be the report of the Committee on Waterworks and Water Supply, by J. L. Ludlow, Chairman, of Winston-Salem, North Carolina.

MR. LUDLOW: I wish to say that in formulating my report I have to some extent verged on the scope of the following assignment which you have given me on the program, "Some Notes on the Current Growth and Extensions of Public Water Supplies," so that all I have to say will be confined to this report of the committee. (See page 75.)

THE PRESIDENT: We will next have a paper by Mr. George W. Fuller, Consulting Engineer, New York City, on "Importance of the Proper Operation of Water Purification Plants."

MR. FULLER: I have taken the liberty of changing this title to read "The Proper Operation of Water and Sewage Purification Plants." For the most part these comments are applicable to either type, but there are a few words in connection with sewage purification projects which I wish to mention in connection therewith. (See page 80.)

THE PRESIDENT: If there is no further discussion we will pass to our next topic, the report of the Committee on Review, by the chairman, Mr. C. D. Pollock, of Brooklyn, New York. (See page 55.)

THE PRESIDENT: Next in order will be a paper on "Sewage Purification vs. Water Purification; a Review of the Arguments," by Mr. George C. Whipple, Consulting Engineer, of New York City. (See page 99.)

THE PRESIDENT: The next subject is "Fire Protection." Mr. Chausse expected to be present, but I have received a

telegram from him stating that on account of illness he would not be able to reach Atlantic City. This, therefore, completes all the matters for this forenoon.

Upon motion, duly seconded, and carried, adjournment was taken until 8 o'clock P. M., the same day.

EVENING SESSION.

The fourth session of the Convention was called to order by the President at 8:10 P. M.

THE PRESIDENT: The first thing in order this evening will be the report of the Committee on Park Development and Maintenance, by Mr. James Owen, of Newark, New Jersey. (See page 144.)

THE PRESIDENT: We will now have Mr. Reynolds' paper. (See page 157.)

THE PRESIDENT: The next thing is a paper on the "Practical Results of the Control of Shade Trees," by Mr. Solotaroff, Superintendent and Secretary of the Shade Tree Commission of East Orange, N. J. Mr. Solotaroff's paper will be illustrated by lantern slides. (See page 146.)

MR. WARREN: I am sure we have all been highly interested in this address. I feel it alone has been worth several times the trouble and expense of a trip fom Boston to Atlantic City. I do not know whether it is customary, but I would move a vote of thanks to Mr. Solotaroff for his lecture.

(*Motion duly seconded and carried.*)

THE PRESIDENT: The next subject on the program is the consideration of street pavements; but before we take that up, Mr. Putnam, of Rochester, has a couple of slides showing some apparatus used in the laboratory at Rochester which he would like to show. (*Not furnished for publication.*)

THE PRESIDENT: We will now take up the consideration of the subject of street pavements. I would like to say first

that the Committee on Pavements have been investigating the subject during the year with a special aim in view, but have not succeeded in establishing any fixed result, so they are not in a position to report. Consequently, instead of making a formal report, they present the papers which will be read here this evening. The first one I will call for will be "Imperial Roads, Their Aims and Accomplishments," by Mr. William B. Spencer, Vice President of the Imperial Roads Company, of New York City. (See page 164.)

THE PRESIDENT: We will now have a paper on "The Proper Construction of Brick Street Pavements," by Mr. W. P. Blair, Corresponding Secretary of the National Paving Brick Manufacturers' Association, of Indianapolis, Indiana. (See page 175.)

THE PRESIDENT: If there is no objection, we will let the other papers go over until tomorrow morning, and will now have the report of the Nominating Committee.

The report of the Nominating Committee was read by the Secretary, as follows:

Your committee beg leave to report the following selections for officers of the Society for the incoming year: For President, James Owen, of Newark, N. J.; for First Vice-President, Julian Kendrick, of Birmingham, Ala.; Second Vice-President, Fred Giddings, of Atchison, Kan.; Third Vice-President, E. A. Kingsley, of Little Rock, Ark.; for Treasurer, Edward S. Rankin, of Newark, N. J., and for Secretary, A. Prescott Folwell, of New York City. As Chairman of the Finance Committee, W. J. Parkes, of Pine Bluff, Ark., with J. N. Hazlehurst, of Atlanta, Ga., and F. T. Ellwood, of Rochester, N. Y., as his associates.

Respectfully submitted,

E. A. KINGSLEY, Chairman.

MR. WARREN: I would suggest that if there are no further nominations, the nominations be closed and that the Secretary be directed to cast the ballot for the nominees.

Motion seconded.

MR. ANDREWS: I will move that the President be directed to cast the vote of the Society for Mr. Folwell as Secretary.

Motion seconded, carried, and the vote is cast, and Mr. Folwell declared elected.

Motion as to other officers carried, and Secretary casts unanimous vote of Society for said persons, and same are declared duly elected.

THE PRESIDENT: We will now listen to the report of the Committee on Next Place of Meeting.

MR. RANKIN: The Committee on Next Place of Meeting had so many good things offered to it that it was rather difficult to decide. The cities of Chicago, Cincinnati, Rochester, Buffalo, Toronto, Hamilton and Little Rock all either sent or brought invitations. The committee tried to be governed entirely by what they considered to be the best interests of the Society, and in making their selection have had in mind especially the possible increase in the membership, the social features which might be expected from the different cities, and also what seems to be an established precedent, of as far as possible going to a different part of the country each year. Having all these things in view, your committee unanimously decided to recommend to the Society the City of Little Rock, Arkansas. I was authorized to say that the Society would be received with open arms by the city officials and also by the citizens, and that the hotel accommodations would be found ample and excellent. I would also say that I was told on the quiet that the present laws were not very strict and that election is past. Owing to the location of Little Rock, your committee would recommend that the meeting be held the second week in November.

MR. KINGSLEY: I move that the report of the committee be adopted.

MR. FISHER: I will second that motion. I will say in addition that while the City of Rochester is one of the applicants for the convention next year, that we yield and are in the field for it the year after.

Mr. Warren: I was not present at the meeting last year, but I believe that one gentleman from Arkansas withdrew in favor of Atlantic City because it was a convenient place to get a bath. I would third the nomination of Little Rock, and suggest that it is a good and convenient place to get a drink.

Motion carried.

Mr. Kingsley: Representing the Little Rock City Council, the Little Rock Board of Trade and the Little Rock Business Men's League, I wish to extend to the Society and to the committee our thanks for your acceptance of our invitation, and I wish to say right now that the courtesies of the city will be openly extended. We expect to show the Society next fall—in November, if you please to come in November—what the true Southern courtesy can be and is, and I want to urge upon each one of you to come to Little Rock and see what we have got to show you, and help us in what we have to do.

Upon motion, adjournment was taken until Thursday morning at 9:30 o'clock.

THURSDAY, OCTOBER 22.

Morning Session.

The fifth session of the Convention was called to order at 9:45 A. M., on Thursday, October 22nd, by the President.

The President: Before proceeding with our program we have some little business to transact. We will first have the report of the Finance Committee.

REPORT OF THE FINANCE COMMITTEE.

The Finance Committee has examined the Treasurer's report, and the Secretary's books and vouchers, and find them correct.

(Signed) A. F. EGGERS, *Chairman.*

The President: If there are no objections, the report will be received and placed on file.

No objections were offered.

The President: There are two amendments to the constitution to be considered at this time. They were proposed the first day, and the constitution provides that they may be taken up at any time after the first day. The first is to Article III, and the Secretary will read such article and the proposed amendment.

The Secretary: Article III is entitled "Fines and Dues," and has one section as follows: "Each corporate member shall pay $5.00 per annum, and each associate member shall pay $10.00 per annum." The amendment suggested is to add the clause "except that if more than one representative of a given company be members, one shall pay a fee of $10.00 and the others $5.00 each."

Upon motion, duly seconded, said amendment was adopted.

The Secretary: The other amendment was submitted in writing by Mr. Howard, and is an amendment to Article II, Section 4. It now reads, "Any member who shall be in arrears for more than one year's dues shall be considered as no longer a member of this Society and his name shall be discontinued from the roll by the Secretary." As amended it will read,

"Any member who shall be in arrears for more than one year's dues *may* be considered as no longer a member of this Society and his name *may* be discontinued from the roll of the Society at the discretion of the Executive Committee."

Motion to adopt amendment by Mr. Rust; motion seconded and carried.

THE PRESIDENT: It has always been our custom to have a committee on resolutions appointed to draw up certain resolutions regarding the courtesies that have been extended during the meeting by residents of the city and the different officials.

MR. OWEN: I move you, Mr. President, that the chair appoint this committee.

Motion seconded, and carried.

THE PRESIDENT: There are still a few applicants for membership. If there is no objection, the rules will be suspended and we will act on these applications at the present time.

THE SECRETARY: The new applicants are: The Rudolph S. Blome Company, of Chicago, Ill., for associate membership; Thomas A. Barrett, of Wilkes-Barre, Pa., Street Commissioner, for corporate membership; W. C. Parmelee, of New York, Consulting Engineer, for corporate membership, and The Municipal Journal and Engineer, of New York, for associate membership.

MR. OWEN: I move the Secretary cast the ballot for these gentlemen and firms whose names have been read.

Motion duly seconded, and carried, and Secretary so casts ballot, and applicants are declared duly elected in their respective classes.

THE PRESIDENT: At the last meeting there was some suggestion about a badge for the Society, and the Secretary has had some designs made for that purpose. Is there any information desired from the Secretary on this subject?

MR. BROWN: I have a design here which has been obtained from the same firm that makes the badges for the American Society of Civil Engineers. It seems to be a very neat and appropriate design, and can be obtained in gold for $1.25, or

rolled gold for 40 cents. I would suggest that this design be approved by the members present or referred to the Board of Directors for their action.

THE SECRETARY: We have had many designs suggested, but this seems to be the only one that is satisfactory and that is the reason we recommend it here today. It was difficult for us to get anything that typified the Society because we cover such a wide scope. A number of firms thought they could furnish us a design typical of our Society, but after some attempt gave it up. The design recommended is a conventional figure, simple and neat, consisting of a circle of enamel with a four-pointed star, each point consisting of a lozenge of enamel, the whole enclosed in gold, and in the four lozenges of the star are the initials of the Society, "A. S. M. I."

MR. KINGSLEY: If this is the report of the Committee, I move that it be adopted, and that the badge recommended by the committee be made the official badge of the Society.

Motion duly seconded, and carried.

THE SECRETARY: In connection with this, I think there is some evidence in this meeting of what good a modest and proper amount of publicity by the Society can accomplish. I do not think we have blazoned our name forth in the daily or weekly press more than was seemly, but we have let the city officials of this country know something about us. A little over a year ago I received a letter from a firm of municipal engineers in the middle west asking if there was not a Society with a name something like ours. They had never even heard of our Society. I thought that condition should be removed. I think this same publicity should be continued, and that every member should help along that line, in a seemly and modest way, of course, but by letting people know that we have a Society.

Some of the members have adopted the suggestion made at the convention a year ago, and later through a circular letter

of mine, that they place on their letterheads, "Member of American Society of Municipal Improvements." That shows that we are proud of our Society, and it shows our friends that the Society amounts to something. Another suggestion made last year was that when a seal or design was adopted by the Society, we should use it as much as we could in our work, and if it meets with the approval of the Society, the Secretary will have some small pasters with the seal of the Society prepared, that can be pasted on the back of our envelopes as a seal to help advertise the Society. It was suggested last year that this would help make the Society known among engineers. I would like to have an expression from the Society as to that, and if they wish I can have these pasters made cheaply and sold to the members at a nominal cost.

Mr. Kingsley: I think the publicity is exemplified by this meeting, the best meeting we have had for some time. The meeting has been advertised and many others desired and intended to come, but owing to the month of October in a good many communities being the month in which we finish much of our work, they have been deterred. I think, especially as the meeting is to be in our city, that if you set the second week in November, you will get around these difficulties, especially in the central and north central states. I like the Secretary's suggestion.

There is another suggestion upon which I would like to ask a question. Major Parkes, of Pine Bluff, brought the matter up in Detroit and talked it over with several of us there and a number of times after we went back to Arkansas. That was, wouldn't the Society gain some publicity, and get more nearly to mean what the Society actually is, were the name changed from "The Society of Municipal Improvements," to "The Society of Municipal Engineers"? The corporate members, as I understand, are practically all engineers.

The President: No, that is not correct. The idea has always been not to confine it to engineers, but to have the legislative and executive officers of a city members, and include,

besides the actual physical work of the cities, the legal and governmental part.

MR. KINGSLEY: That being the case, I beg to withdraw that proposition. Major Parkes was very anxious to have the matter brought up in this meeting, and in his absence I felt I would like to ask that question.

THE PRESIDENT: On the Committee on Resolutions, I will appoint Messrs. Rust, Tribus and Brown.

If there is nothing else, we will now proceed with our regular order of papers where we left off last night, and the first one is "Concrete Pavements; the Blome Method," by Mr. H. S. Dewey, of New York City. (See page 194.)

THE PRESIDENT: We will proceed to the next paper, which is "The Solution of Road Construction Commensurate with the Requirements of Modern Traffic as Offered by the Hassam Pavement," by Mr. Magill, of New Haven, Conn. (See page 216.)

THE PRESIDENT: I would like to ask all of the speakers to send to the Secretary such photographs and plans as will illustrate the papers they have read, so that when they are printed these illustrations may accompany them in the Proceedings.

We will next have a paper on "The Maintenance and Repair of Asphalt Pavements," by Mr. Lutz, of Kansas City. (See page 228.)

MR. BARROW: During the papers that have just been read and the discussions that followed, allusions were made to the street car rails. In the city whence I come there has been a great deal of discussion as to the merits of different rails; whether the "T" rail or girder rail is the best; and I thought it might not be out of order if I could get an expression of opinion on a subject which I think is of great importance.

MR. BROWN: I might say that quite recently I was examining the subject to some extent in Columbus, Ohio, and I found the officials in Columbus were very much opposed to the "T"

rail construction. They have this month a suit on with the street car company in which they are trying to force them to put in a grooved rail, and the street car people are trying to put in, at least on their interurban lines, a "T" rail. In opposition to that I examined a pavement in Dayton which has just a "T" rail laid with special formation of brick, in which a thin brick is put against the web of the rail and then another brick with a small corner cut off of it next to that, which makes a rather wide groove next to the rail on the inside. That is for the purpose of giving the heavier flanges of the interurban cars the room that is necessary; that is plenty wide enough if the bricks are not chipped by the movements of the wheels; and that is a perfect pavement. Against that, in Indianapolis we have a similar construction which is not so satisfactory as that in Dayton, but I think probably the difficulty is in the foundation to the rails and ties rather than in the construction and use of the "T" rail itself.

THE PRESIDENT: I think in the East the accepted result is that in all paved streets the street car rail must be a grooved rail.

The next thing in order will be the regular business program of today, and first is the report of the Committee on Disposition of Garbage and Street Cleaning.

MR. PARKER: Before a new subject is introduced, I would like the attention of the organization for a few minutes. Until yesterday I enjoyed the unique distinction of being the only member of the Association who lived in Atlantic City. I was proud of living in Atlantic City and equally proud of my membership. I know of nothing more important in the way of municipal improvements than the permanent pavement of city streets. Of that phase of the proposition I have nothing to say at this time.

We are in convention here, in a city which within the last four years has spent one million dollars in permanent municipal improvements. The evolution of Atlantic City as a result

of having pavement is beyond comprehension. I know of no city in the United States where, within a reasonable area, there are so many varieties of established pavements laid and open to inspection. I would like to direct the attention of the members here to the fact that they can see on the streets of Atlantic City creosoted wooden blocks, asphalt, vitrified brick, and bitulithic. It is here, and without advocating or being understood as advocating any particular pavement, I would carefully direct your attention to an inspection of these pavements as laid in Atlantic City.

In regard to street car construction and the vibration of the rails, I will say that in Atlantic avenue here, as laid, the processes and practices referred to would almost show that vibration had been precluded. A significant fact is that the heavy steam locomotives of the Pennsylvania railroad are in operation to a limited extent on that street car track. The construction is unique and has been satisfactory, and a very careful examination, I think, will show an absolute absence of vibration.

You are all interested in paving. I don't know that there is anything new or novel here, but I do want you to look at the up-to-date pavements as laid in Atlantic City. The city has not experimented any. They have confined their paving operations to the standard pavements. The pavements will speak for themselves, and I should like to have you see them.

Mr. Tribus: What is your construction here on your street car tracks?

Mr. Parker: The foundation is six inches of concrete under everything; on top of it is two inches of crushed stone, on which the ties are laid, and they are imbedded in and covered with concrete. It is distinctly not a cheap construction; it is an expensive construction, but a good one.

Mr. Tribus: In our experiments in Richmond we find a great deal of trouble from the vibration on street car tracks, and there we have adopted in all our new work a longitudinal

concrete girder, and steel I-beam cross ties bedded in these girders, to which the rails are bolted; the whole being encased in the concrete foundation of the pavement. Since that foundation has been adopted we have had no repairs due to vibration.

THE PRESIDENT: We will now have the report of the Committee on City Government and Legislation, by Mr. Horace Andrews, Chairman, of Albany, New York. (See page 7.)

THE PRESIDENT: We will next have the report of the Committee on Municipal Franchises, and a paper, "A Modern American Public Service Franchise," by Mr. C. C. Brown, of Indianapolis.

MR. BROWN: I move you, Mr. President, that my report and paper and the paper by Mr. Isaac R. Breen, of Watertown, N. Y., "A Municipal Franchise Is a Valuable Asset and Should Be Treated as Such by Those in Authority," be read by title and printed in the report. (See pages 18, 20 and 27.)

THE PRESIDENT: If there is no objection, they will be so considered.

No objection was offered.

THE PRESIDENT: The Committee on Resolutions will now make its report.

MR. RUST: *Resolved,* That the cordial thanks of this Association be tendered to the Publicity Bureau, to the business men of Atlantic City, to the management of the Hotel Dennis, to the city officials of Atlantic City, the Garbage Reduction Company, and to the Atlantic City Sewerage Company for the opportunity to examine their plants; and to the press for the reports of the meetings of the Association.

C. H. RUST, Chairman.
L. L. TRIBUS,
C. C. BROWN.

Upon motion, duly seconded and carried, the report of the Committee on Resolutions was adopted.

THE SECRETARY: We have one more application, that of

Mr. B. K. Finch, City Engineer of Wilkes-Barre, Pa., for corporate membership.

Moved, seconded, and carried, that the Secretary be instructed to cast the vote of the Society for Mr. Finch. Secretary casts vote, and Mr. Finch is declared elected.

MR. TRIBUS: It seems a pity that these excellent reports last made have not been the subject of discussion by the members of this body. Is there not some plan by which they might be submitted to the members for discussion?

MR. BROWN: I will say that my report and paper and part of Mr. Breen's paper have been set up, and I believe arrangements could be made so that they might be submitted to the members.

MR. TRIBUS: I move that the matter of sending out copies of the papers that have been read before the meeting, and upon which no discussion was had, be left to the President and Secretary with power to do as they think best.

Motion duly seconded, and carried.

THE PRESIDENT: That constitutes all the business of the convention. It has been customary at this time for the elected officers of the Society to make their speeches of acceptance.

I congratulate you, Mr. Owen, upon your election as President of this Society.

MR. OWEN: I do not know as it is worth while to make any extended remarks at this moment; but we are, I think, starting a new era in the development of this Society. I think we should be congratulated on the efforts of the retiring President, and I may add on the efforts of the Secretary, because of the enormous addition to the membership of this Society. My hope and ambition will be that this progress shall not stop but continue in increasing ratio. My hope is that in the course of ten years this Society may come to be of as great importance, and its operation of as great weight in the development of this country, as the kindred associations that are of

so much prominence today. I can assure you that whatever effect my small efforts may have, they will be to that end, and I hope that when we meet at Little Rock, all of us will be there, and all who could not be here but can be there, will not only go to Little Rock, but will do all we can toward increasing the membership of the Society and toward inducing the members to be present at the next meeting.

MR. KINGSLEY: In connection with what the President has said I would like to say that if the meeting is held in November, as November 1st opens up the hunting season in Arkansas, if there are any gentlemen who really enjoy hunting, most pleasant trips for hunting purposes for two or three or four days or a week can be arranged. We have many sportsmen who enjoy that class of sport. The deer season opens up the first of November and the hunting and fishing are very fine. Some of the members may enjoy a few days of recreation and pleasure of that kind.

Request for speech from the new First Vice-President, Mr. Kendrick.

MR. KENDRICK: I am inclined to be long-winded, and as it is getting toward the noon hour, I will simply thank the Society for the honor they have conferred upon me, and assure them of my best efforts during the ensuing year.

Mr. Fred Giddings, the Second Vice-President, not being present, request was made for a speech by Mr. Kingsley, Third Vice-President.

MR. KINGSLEY: I have done almost as much talking as Major Howard. I have tried to keep up with him, and I think a few of us have done pretty nearly our share. I will say, however, that I fully appreciate the favor, in the first place, that you did us by selecting Little Rock as our next place of meeting, and I am going to show you that Little Rock does appreciate this favor. And in the second place, I appreciate more than the selection of Little Rock the honor you have done me by selecting me as Third Vice-President of this Society. It

was an honor entirely unsought and came entirely by surprise to me. I certainly do appreciate it and I am going to labor to do the best I can and help Mr. Owen in every way I can to make the Little Rock convention better than the Atlantic City convention, which, I believe, is the best up to date.

Upon motion, duly seconded, and carried, adjournment was had, the Society to meet at Little Rock, Arkansas, some time in 1909, the exact date to be later determined.

REGISTERED AT THE ATLANTIC CITY CONVENTION.

CORPORATE MEMBERS.

Clark G. Anderson	Moline, Ill.
Horace Andrews	Albany, N. Y.
E. E. Barrow	Hamilton, Ont.
C. V. Bauman	Newark, N. J.
Chas. C. Brown	Indianapolis, Ind.
B. E. Briggs	Erie, Pa.
Frank J. Bock	Newark, N. J.
T. A. Barrett	Wilkes-Barre, Pa.
Edward H. Christ	Grand Rapids, Mich.
P. H. Connolly	Racine, Wis.
Leslie V. Christy	Wilmington, Del.
S. Cameron Corson	Norristown, Pa.
Robert H. Canfield	Corning, N. Y.
Alfred Clark	Concord, N. H.
Arthur R. Denman	Newark, N. J.
A. W. Dow	New York City.
A. F. Eggers	Newark, N. J.
Frederick T. Elwood	Rochester, N. Y.
A. Prescott Folwell	New York City.
Edwin A. Fisher	Rochester, N. Y.
George W. Fuller	New York City.
B. K. Finch	Wilkes-Barre, Pa.
D. B. Goodsell	New York City.
Fred Giddings	Atchison, Kan.
J. Herbert Grant	Rochester, N. Y.
William A. Howell	Newark, N. J.
John T. Hanks	Ridgewood, N. J.

REGISTERED AT THE ATLANTIC CITY CONVENTION—(Continued).

William J. Horrigan	Wilmington, Del.
W. B. Howe	Concord, N. H.
Thomas F. Halpin	Newark, N. J.
John B. Hittell	Chicago, Ill.
J. W. Howard	New York City.
J. W. Hackney	Atlantic City, N. J.
E. A. Kingsley	Little Rock, Ark.
Julian Kendrick	Birmingham, Ala.
George H. Lambert	Newark, N. J.
J. L. Ludlow	Winston-Salem, N. C.
John B. Morris	Newark, N. J.
B. B. Meriwether	Birmingham, Ala.
W. F. McClure	Berkeley, Cal.
John C. McAvoy	Philadelphia, Pa.
Kenneth D. Owen	Montclair, N. J.
James Owen	Newark, N. J.
C. D. Pollock	New York City.
W. C. Parmley	New York City.
Joseph E. Putnam	Rochester, N. Y.
Edward S. Rankin	Newark, N. J.
C. H. Rust	Toronto, Ont.
Charles M. Reppert	Pittsburg, Pa.
A. M. Reynolds, Jr.	Newark, N. J.
W. W. Reed	Green Bay, Wis.
Francis P. Smith	New York City.
William Solotaroff	East Orange, N. J.
Morris R. Sherrerd	Newark, N. J.
H. S. Sprague	Pittsburg, Pa.
E. B. Schmidt	Terre Haute, Ind.
John B. Stobaeus	Newark, N. J.
George W. Tillson	New York City.
A. J. Taylor	Wilmington, Del.
Louis L. Tribus	New York City.
J. J. Ward	Toronto, Ont.
W. M. Wilson	Gadsden, Ala.
G. C. Whipple	New York City.
R. M. Watson	Rutherford, N. J.

ASSOCIATE MEMBERS.

W. G. Bickell, Barrett Mfg. Co.	New York City.
Will P. Blair, N. P. B. Mfrs. Ass'n	Indianapolis, Ind.

REGISTERED AT THE ATLANTIC CITY CONVENTION—(Continued).

James T. Bannen....................................Milwaukee, Wis.
G. D. Carr, Standard Asphalt & Rubber Co.........Chicago, Ill.
W. S. Gurnee, Jr., Power Specialty Co.............New York City.
B. F. Granger, Reinforced Concrete Pipe Co.......Jackson, Mich.
William H. Gilligan, Newark Paving Co...........Newark, N. J.
F. S. Hutchinson...................................New York City.
Newton Jackson, U. S. Wood Preserving Co.......Philadelphia, Pa.
G. H. Lutz, Equitable Asphalt Maintenance Co.....Kansas City, Mo.
Coleman Meriwether, President Lock Joint Pipe Co New York City.
H. A. Miner, Steel Protected Concrete (Wainright Curb).......................................Philadelphia, Pa.
C. A. Magill, Conn. Hassam Paving Co............New Haven, Conn.
R. H. Parker, United Paving Co....................Atlantic City, N. J.
E. Vail Stebbins, Power Specialty Co..............New York City.
G. E. Sly, Municipal Journal and Engineer.........New York City.
W. B. Spencer, Vice-President Imperial Road Co...New York City.
Geo. O. Tenney, Pres., Atlantic Bitulithic Paving Co.Richmond, Va.
George C. Warren..................................Boston, Mass.
Harold B. Weaver, Secretary Imperial Road Co.....New York City.

GUESTS.

Mrs. E. E. Barrow.................................Hamilton, Ont.
Mrs. C. V. Bauman................................Newark, N. J.
Miss Bauman.......................................Newark, N. J.
Mrs. E. V. Blocker................................Red Bank, N. J.
Mrs. F. J. Bock....................................Newark, N. J.
M. N. Baker..New York City.
F. M. Barnard......................................Minneapolis, Minn.
Walter Buehler.....................................Minneapolis, Minn.
Mrs. E. H. Christ..................................Grand Rapids, Mich.
Anne R. Corson....................................Norristown, Pa.
Mrs. A. F. Eggers.................................Newark, N. J.
Mrs. S. Alice Gould...............................Lancaster, N. H.
W. S. Goodwin, The Texas Co.....................New York City.
C. H. Pindell.......................................Boston, Mass.
Mrs. C. D. Pollock................................New York City.
Mrs. M. K. Sherrill................................Brooklyn, N. Y.
Mrs. Lucy Stobaeus...............................Newark, N. J.
E. C. Stremple.....................................Newark, N. J.
C. R. Soley..Rutherford, N. J.
Mrs. C. R. Soley...................................Rutherford, N. J.
H. Tipper...New York City.

REGISTERED AT THE ATLANTIC CITY CONVENTION—(Continued).

E. H. Thomes.................................... New York City.
Mrs. George W. Tillson........................... New York City.
S. B. Whinery.................................... New York City.
Mrs. R. M. Watson................................ Rutherford, N. J.
Mark Winchester.................................. Toledo, Ohio.
Mrs. George C. Warren............................ Boston, Mass.

EXHIBITS AT THE CONVENTION.

The exhibits received a great deal of attention from the members, and made a very attractive display. They were as follows:

WARREN BROTHERS' COMPANY—Samples of material and of completed pavements, and literature.

POWER SPECIALTY COMPANY—Large model of a Heenan Refuse Destructor, with removable parts to show interior.

LOCK JOINT PIPE COMPANY—Short length of model of pipe, Meriwether system, with vitrified brick lining in the invert.

KINDLING MACHINERY COMPANY—Photographs and literature.

NATIONAL PAVING BRICK MANUFACTURERS' ASSOCIATION—About 75 samples of bricks, including samples of bad and good work.

STANDARD ASPHALT & RUBBER COMPANY—Samples of "Sarco" asphalt and of mineral rubber roadways, photographs and literature.

UNITED STATES WOOD PRESERVING COMPANY—Treated wood blocks, sample of Tremont street (Boston) pavement laid nine years ago.

BARRETT MANUFACTURING COMPANY—Photographs and literature.

REINFORCED CONCRETE PIPE COMPANY—Three large, full-size pipe, literature and photographs.

S. CAMERON CORSON—Aluminum model of catch basin, literature.

CONSTITUTION AND BY-LAWS,

OFFICERS AND COMMITTEES

AND

LIST OF MEMBERS

CONTENTS OF PREVIOUS PROCEEDINGS

AND

ADVERTISEMENTS

CONSTITUTION OF THE SOCIETY.

ARTICLE I—Name and Object.

Section 1. The objects of this Society, which shall be known as "The American Society of Municipal Improvements," shall be to disseminate information and experience upon, and to promote the best methods to be employed in the management of municipal departments, and in the construction of municipal works, by means of annual conventions, the reading and discussion of papers upon Municipal Improvements, and by social and friendly intercourse at such conventions, and to circulate among its members, by means of an annual publication, the information thus obtained.

ARTICLE II—Membership.

Section 1. Any municipality within America shall be eligible to membership in this Society; likewise any engineer, officer, or director who shall have charge of or supervision over or be employed as a consulting engineer on any public or municipal department work.

Any member who shall have ceased to have charge or supervision of any public or municipal department or work may retain his membership, unless he shall have come under the restrictive requirements of associate membership, when he shall retain membership as an associate only.

Sec. 2. Every application for membership shall be in writing, stating the name, location and department, if any; and, if of an individual, shall also state age, residence and position of the applicant, if any.

Sec. 3. Any proper person interested in municipal improvements or work as a contractor or contracting agent or who is a manufacturer or dealer in municipal supplies, may become an associate member, who shall enjoy all the rights and privileges of full membership, excepting that of holding office or voting.

Sec. 4. Any member who shall be in arrears for more than one year's dues may be considered as no longer a member of this Society, and his name may be discontinued from the roll of the Society at the discretion of the Executive Committee.

Sec. 5. Any member may withdraw from the Society upon payment of all dues to date, and by notifying the Secretary thereof in writing.

Sec. 6. Any member may be expelled from the Society upon the recommendation of the Executive Committee adopted by a two-thirds vote of all the members present.

ARTICLE III—Fees and Dues.

Section 1. Each corporate member shall pay five dollars per annum, and each associate member shall pay ten dollars per annum, all dues to be payable in advance, on or before the date of the annual meeting; except that if more than one representative of a given company be members, one shall pay a fee of ten dollars, and the others five dollars each.

ARTICLE IV—Officers.

Section 1. The officers of this Society shall consist of a President, three Vice-Presidents, a Secretary, and a Treasurer, not more than two of whom shall be a resident of the same state, and who, with the Past Presidents who have retained their continuous membership, shall act as an Executive Committee for and in behalf of the Society.

Sec. 2. There shall also be elected a Finance Committee consisting of three members of the Society.

Sec. 3. In case of any of the above positions, excepting the presidency, becoming vacant, or in case of their absence during the annual convention, the President shall fill such vacancy by appointment from the membership.

Sec. 4. There shall be appointed annually the following standing committees:

1. Street Paving.
2. Electric Street-Lighting.
3. Sewerage and Sanitation.
4. Waterworks and Water-Supply.
5. Taxation and Assessments.
6. City Government and Legislation.
7. Disposition of Garbage and Street Cleaning.
8. Review.
9. Municipal Franchises.

The number of each committee shall be three, and the Chairman may add such names as he may deem advisable. No special or standing committee shall be authorized to create any liabilities unless the same shall have been first approved by the Executive Committee.

ARTICLE V—Election.

Section 1. The officers of this Society shall be elected by ballot on the second day of each annual convention, and each municipality shall be entitled to as many votes as it has representatives present.

Sec. 2. The President shall not be eligible for immediate re-election (except by a unanimous vote).

Sec. 3. The officers elected shall assume office immediately after the close of the annual meeting at which they were elected.

Sec. 4. The ballot for any officer may be waived by unanimous consent.

ARTICLE VI—Dues.

Section 1. The President shall preside at the meetings of the Society and at those of the Executive Committee, and shall perform such other duties as are incumbent upon the office. In the absence of the President, or upon his becoming ineligible, the senior Vice-President shall assume and perform the duties of the office.

Sec. 2. The Secretary shall keep accurate minutes of the proceedings of the Society and of the Executive Committee; shall conduct all correspondence; shall issue notices of any meeting of the Society not less than four weeks prior to the date of such meeting; shall collect and receipt for all fees and dues and pay them to the Treasurer quarterly, taking his receipt for the same; and keep accurate account between the Society and its members.

Sec. 3. The Treasurer shall receive from the Secretary and safely keep all moneys belonging to the Society, giving his receipt therefor; shall pay all bills approved by the Finance Committee or the President; shall keep correct account of the funds of the Society, and submit to it at its annual meeting a report of all receipts and disbursements during the preceding year.

Sec. 4. The Executive Committee shall manage all the affairs of the Society, subject to the action and approval of the Society at its meeting. All questions in Executive Committee shall be decided by a majority vote, and five members shall constitute a quorum, not less than four of whom shall be officers of the Society. The Executive Committee shall meet at least once each year, on the morning of the first day of the annual meeting of the Society, and as much oftener as the President may determine. The Executive Committee shall be directed to keep an accurate list of the members of the Society, and to ascertain from time to time whether or not such members are still municipal officers, and if not, to take such steps as may be necessary to secure new members from such cities in which members of the Society are no longer municipal officers—this with a view of insuring the permanency of the association, as well as maintaining and increasing the membership thereof.

Sec. 5. The Finance Committee shall meet on the morning of the first day, and previous to the annual meeting of the Society, to examine and audit the Secretary's and Treasurer's accounts and annual statements, and report thereon to the Society.

Sec. 6. It shall be the duty of the Chairman of each standing committee to prepare a report, with the aid of his fellow-committeemen, and submit the same at the annual meeting.

Sec. 7. One afternoon, and such other time as may be deemed necessary, shall be devoted to sectional work, the Chairman of each standing committee acting as Chairman of the section. The Chairman of each section shall arrange the program of the sectional meetings in connection with the Program Committee of the Society.

ARTICLE VII—Meetings.

Section 1. The annual meeting of the Society shall be held on the second Tuesday in October of each year, in such city as the majority of the members voting shall decide; selection of place of meeting to be made after the officers shall have been elected. Provided, however, that the date may be changed for cause, with the approval of two-thirds of the Executive Committee, all the members to be notified of such change in accordance with Article VI, Section 2.

Sec. 2. At any annual meeting of the Society twenty members shall constitute a quorum for the transaction of business.

Sec. 3. Any member, with the concurrence of the presiding officer, may admit friends to the meeting of the Society, but such person or persons shall not without the consent of the meeting be permitted to take part in any discussion.

Sec. 4. All papers, drawings, etc., submitted to the meeting of the Society shall be and remain the property of the Society.

ARTICLE VIII—Order of Business.

Section 1. At the annual meeting of the Society the order of business shall be as follows:

1. Roll call.
2. Reading of minutes of last meeting.
3. Considering of applications for membership.
4. The President's address.
5. Reports of the Secretary and Treasurer.
6. Report of the Executive Committee.
7. Report of the Finance Committee.
8. Reports of special committees.
9. Reading and discussion of papers.
10. Election of officers.
11. Selecting next place of meeting.
12. General business.

Sec. 2. All questions shall be decided by vote, and all differences of opinion in regard to points of order shall be settled by parliamentary practice as set forth in Cushing's Manual.

ARTICLE IX—Amendments.

Section 1. The foregoing constitution and articles may be amended on or after the second day of any annual meeting of the Society by a two-thirds vote of all members voting; provided such proposed amendment shall have been submitted to the Society in writing on the first day of its annual meeting.

BY-LAWS.

No. 1. Members shall not be permitted to give out for publication any papers, to be submitted to the Society at its annual meeting, in advance of such meetings; and all requests for papers for such purposes shall be referred to the Secretary.

No. 2. All committees and members of the Society shall be required to furnish four copies of all reports, papers or other matters submitted to the Society for its consideration.

No. 3. It shall be the duty of the President, on or before the first day of January of each year, to divide America by States into Territorial Sections, and to assign one or more members of the Executive Committee to each of said sections. It shall be the duty of the members of the Executive Committee thus assigned to keep an accurate list of the municipalities and members of the Society in the particular territory assigned to them, and to ascertain from time to time, whether or not the members of the Society from the territory assigned to them are still municipal officers; and when not, to take such steps as may be necessary to secure new members from such municipalities, as well as to secure membership in the Society of such municipalities and officials in the territory assigned to them that have not acquired the same in the past.

No. 4. The President shall be required, at least sixty days before the holding of the annual convention, to communicate with the local committee having charge of the arrangements of the convention in the city in which the same is to be held, with a view of securing exact data as to place of meeting, entertainment to be furnished, hotel and railroad rates, etc., and to print this information, together with such data relating to the business of the convention as he may have, and turn the same over to the Secretary, or members of the Executive Committee, for distribution.

President, JAMES OWEN

First Vice President,
JULIAN KENDRICK

Second Vice President,
FRED GIDDINGS

Third Vice President, E. A. KINGSLEY

Secretary,
A. PRESCOTT FOLWELL

Treasurer,
E. S. RANKIN

OFFICERS OF THE SOCIETY

FOR THE YEAR

1908-1909.

President	JAMES OWEN	Montclair, N. J.
First Vice-President	JULIAN KENDRICK	Birmingham, Ala.
Second Vice-President	FRED GIDDINGS	Atchison, Kan.
Third Vice-President	E. A. KINGSLEY	Little Rock, Ark.
Secretary	A. PRESCOTT FOLWELL	New York, N. Y.
Treasurer	E. S. RANKIN	Newark, N. J.

Finance Committee

W. J. PARKES, Chairman	Pine Bluff, Ark.
J. N. HAZLEHURST	Atlanta, Ga.
F. T. ELWOOD	Rochester, N. Y.

Executive Committee

The officers of this Society, together with the Past Presidents who have retained their continuous membership, constitute the Executive Committee. The Past Presidents are as follows:

Past Presidents

M. J. MURPHY	St. Louis, Mo.
GEORGE H. BENZENBERG	Milwaukee, Wis.
AUGUST HERRMANN	Cincinnati, Ohio
HARRISON VAN DUYNE	Newark, N. J.
NELSON P. LEWIS	Brooklyn, N. Y.
A. D. THOMPSON	Peoria, Ill.
ROBERT E. McMATH	St. Louis, Mo.
E. A. FISHER	Rochester, N. Y.
C. H. RUST	Toronto, Canada.
GEORGE M. BALLARD (Deceased)	Newark, N. J.
A. PRESCOTT FOLWELL	New York City.
CHARLES C. BROWN	Indianapolis, Ind.
MORRIS R. SHERRERD	Newark, N. J.
GEORGE W. TILLSON	New York, N. Y.

STANDING COMMITTEES

Appointed by the President in accordance with Article IV, Section 4, of the Constitution of the Society.

1908-1909

Street Paving

JOHN B. HITTELL, Chairman....................Chicago, Ill.
GEORGE W. TILLSON...........................New York, N. Y.
FRANK V. P. ELLSWORTH.....................Hot Springs, Ark.

Street Lighting

H. E. BAKER, Chairman..........................Watertown, N. Y.
GEORGE S. IREDELL............................Austin, Texas
EDWARD B. CODWISE..........................Kingston, N. Y.

Sewerage and Sanitation

GEORGE G. EARL, Chairman.....................New Orleans, La.
JOHN W. ALVORD.............................Chicago, Ill.
GEORGE C. WHIPPLE..........................New York, N. Y.

Water Works and Water Supply

J. L. LUDLOW, Chairman........................Winston-Salem, N. C.
THOMAS F. HALPIN...........................Newark, N. J.
CHARLES H. RUST.............................Toronto, Ont.

Taxation and Assessment

R. W. BALL, Chairman...........................Henderson, Ky.
E. A. FISHER...................................Rochester, N. Y.
C. F. TAYLOR...................................Pittsburg, Pa.

City Government and Legislation

HORACE ANDREWS, Chairman.................Albany, N. Y.
R. E. MEADE...................................Birmingham, Ala.
WILLIAM W. SOUTHGATE....................Nashville, Tenn.

Disposition of Garbage and Street Cleaning

L. L. TRIBUS, Chairman..........................New York, N. Y.
WILLIAM J. PARKES...........................Pine Bluff, Ark.
F. T. ELWOOD..................................Rochester, N. Y.

Municipal Franchises

CHARLES CARROLL BROWN, Chairman.......Indianapolis, Ind.
RHODES BROWNE.............................Columbus, Ga.
A. R. GILCHRIST..............................Montgomery, Ala.

Review

C. D. POLLOCK, Chairman......................New York, N. Y.
J. N. HAZLEHURST............................Atlanta, Ga.
E. A. KINGSLEY...............................Little Rock, Ark.

SPECIAL COMMITTEES

Appointed by the President in accordance with resolutions adopted by the Society.

Municipal Data and Statistics

J. W. HOWARD, Chairman .... New York, N. Y.
H. W. WILMOT.................................New York, N. Y.
THOMAS D. ALLIN.............................Pasadena, Cal.

Park Development and Maintenance

A. M. REYNOLDS, Chairman.....................Newark, N. J.
E. A. HARPER..................................Kansas City, Mo.
WILLIAM SOLOTAROFF.........................East Orange, N. J.

Fire Protection

ALCIDE CHAUSSÉ, Chairman..................Montreal, Canada.
J. M. McCARTIN...............................Birmingham, Ala.
W. F. McCLURE................................Berkeley, Cal.

Exhibits for Next Meeting.

E. F. LOWERY, Chairman.......................Jackson, Mich.
G. M. INGRAM..................................Nashville, Tenn.
A. PRESCOTT FOLWELL......................New York, N. Y.
R. H. PARKER..................................Atlantic City, N. J.
E. A. KINGSLEY...............................Little Rock, Ark.

LIST OF MEMBERS

Corporate Members

Membership Dates From

ACKERMAN, J. WALTER, Superintendent, Board of Water Commissioners, Auburn, N. Y. 1905

ALLEN, HENRY C., City Engineer, Syracuse, N. Y. 1908

ALLIN, THOS. D., 203 Kendall Bldg., Pasadena, Cal. 1905

ALVORD, JOHN W., Consulting Engineer, 127 Hartford Bldg., Chicago, Ill. 1899

AMBLER, JOHN N., City Engineer, Winston, N C. 1908

ANDERSON, CLARK G., City Engineer, Moline, Ill. 1908

ANDERSON, L. W., City Engineer. Grand Rapids, Mich. 1900

ANDREWS, HORACE, 125 Lancaster St., Albany, N. Y. 1898

ATWOOD, JOSHUA, 3rd, Rm. 70, City Hall, Boston, Mass. 1908

BAKER, HENRY E., City Engineer, Watertown, N. Y. 1905

BALL, R. W., City Engineer, Henderson, Ky. 1906

BARLOW, JOHN R., City Engineer, Montreal, Canada. 1902

BARR, J. CARROLL, Economy, Pa. 1904

BARRETT, THOS. A., City Hall, Wilkes-Barre, Pa. 1908

BARROW, E. S., City Engineer, Hamilton, Ont. 1903

BAUMAN, C. V., Board of Trade, Newark, N. J. 1899

BEARD, ELMER H., City Engineer, Reading, Pa. 1908

BENZENBERG, GEO. H., Consulting Engineer, 1310 Wells Bldg., Milwaukee, Wis. 1894

BERRY, GEORGE. Assistant Engineer, Bureau of Highways, Borough of Brooklyn, N. Y. 1905

BINGHAM, CLARENCE A., Borough Engineer, Carlisle, Pa. 1908

BLAIR, BRYCE R., City Engineer, Carbondale, Pa. 1905

BOCK, FRANK J., Board of Public Works, Newark, N. J. 1906

BOLEY, C. U., City Engineer, Sheboygan, Wis. 1896

BRIGGS, B. E., City Engineer, Erie, Pa. 1902

BROWN, CHARLES CARROLL, Consulting Engineer, Editor Municipal Engineering, Indianapolis, Ind. 1895

BROWN, FRANK D., City Engineer, Shawnee, Okla. 1908

BROWNE, RHODES, Mayor, Columbus, Ga. 1908

BROWN, THURBER A., 416 E. Church St., Elmira, N. Y. 1908

Membership Dates From

CAMPBELL, W. C., Superintendent Public Works, Columbus, Ga.......1907
CANFIELD, ROBERT H., Superintendent Public Works, Corning, N. Y...1908
CARPENTER, GEORGE A., City Engineer, Pawtucket, R. I................1905
CHAUSSE, ALCIDE, City Architect and Superintendent of Buildings, 1433 Hubert St., Montreal, Canada....................................1901
CHRIST, EDWARD H., Suite 7, Norris Bldg., Grand Rapids, Mich......1908
CHRISTY, L. V., Secretary Street and Sewer Dept., Wilmington, Del...1903
CLARK, ALFRED, Commissioner of Highways, Concord, N. H...........1908
CODWISE, EDWARD B., City Engineer, Kingston, N. Y.................1906
COLLIER, HENRY L., Commissioner of Public Works, Chamber of Commerce, Atlanta, Ga...1908
CONNOLLY, P. H., City Engineer, City Hall, Racine, Wis..............1908
COOPER, SAM'L L., City Engineer, Yonkers, N. Y.....................1908
CORSON, S. CAMERON, Borough Engineer, City Hall, Norristown, Pa...1908
CRANDALL, WM. S., Tribune Bldg., New York City...................1902

DALTON, E. L., Dallas, Texas...1906
DALRYMPLE, F. W., City Engineer, Bayonne, N. J....................1905
DENMAN, A. R., Chairman, Dept. of Streets and Highways, Newark, N. J..1906
DINGLE, JAMES H., City Engineer, City Hall, Charleston, S. C........1908
DOUGHTY, JOSHUA, JR., County Engineer, Somerville, N. J............1908
DOW, A. W., Consulting Chemist, 24-26 E. 21st St., New York City....1906

EARL, GEO. G., Gen'l Supt. Sewerage and Water Board, New Orleans, La..1906
EDGERLY, R. J., City Engineer, Albany, Ga..........................1908
EGGERS, AUGUSTUS F., Board of Works, Newark, N. J................1902
ELLSWORTH, FRANK V. P., City Engineer, Hot Springs, Ark..........1908
ELWOOD, F. T., Rochester, N. Y....................................1907
ELY, JOHN H., Architect, Newark, N. J...............................1907
ENDEMANN, HERMAN K., N. E. Corner Park and Highland Aves., Jamaica, N. Y...1908
ERWIN, M. C., Office Engineer, O'Neil Engineering Co., Dallas, Texas.1908

FINCH, B. K., City Engineer, Wilkes-Barre, Pa.......................1908
FIRTH, JOSEPH, City Engineer, Charlotte, N. C.......................1908
FISHER, E. A., City Engineer, Rochester, N. Y.......................1896
FISHER, JAMES F., City Engineer, Williamsport, Pa..................1908
FLOYD, WILLIAM H., JR., Civil Engineer, 413½ Francis St., St. Joseph, Mo...1905
FOLWELL, A. PRESCOTT, Editor, Municipal Journal and Engineer, 239 West 39th St., New York City....................................1901

Membership Dates From

FORT, E. J., Chief Engineer of Sewers, Borough of Brooklyn, N. Y....1905

FORTUNE, WM., Publisher Municipal Engineering, Indianapolis, Ind...1900

FREIBERG, M. J., Waterworks Commission, 216 E. Front St., Cincinnati O. 1898

FRESHNEY, S. A., Secretary and General Manager, Board of Public Works, Grand Rapids, Mich....1905

FULLER, GEORGE W., Consulting Engineer, 170 Broadway, New York City 1906

FULLER, W. B., 32 W. 40th St., New York City....1907

GAINEY, W. H., City Engineer, Valdosta, Ga....1906

GARDNER, GEO. H., 784 Broad St., Newark, N. J....1908

GERHARZ, HENRY, City Engineer, Billings, Mont....1908

GIDDINGS, FRED, City Engineer, Atchison, Kan....1896

GILCHRIST, ALLEN R., City Engineer, Montgomery, Ala....1906

GOODELL, JOHN M., Editor Engineering Record, 239 W. 39 St., New York City 1904

GOODSELL, DANIEL B., Ass't Engineer, Bureau of Highways, Manhattan, 36 Washington Sq., New York City....1907

GRANT, JUSTUS H., Special Ass't City Engineer, Rochester, N. Y....1908

GREENALCH, WALLACE, Commissioner of Public Works, Albany, N. Y..1908

GRIFFITHS, JOHN D., Assistant Engineer, Dept. Water Supply, Gas and Electricity, Rm. 41 Municipal Bldg., Brooklyn, N. Y....1905

GRIGGS, JULIAN, Scioto Valley Traction Co., Columbus, Ohio....1904

GRIMES, EDWIN L., City Engineer, Troy, N. Y....1908

HACKNEY, JOHN W., City Engineer, Atlantic City, N. J....1908

HALL, EDMUND, Rm. 8 Priest Bldg., Granite City, Ill....1908

HALPIN, THOS. F., Board of Public Works, Newark, N. J....1907

HALSEY, EDMUND R., 41 Delaware Ave., South Orange, N. J....1908

HAMMOND, GEO. T., 156 Berkeley Place, Brooklyn, N. Y....1908

HANKS, JOHN T., Secretary, Board of Health, Ridgewood, N. J....1908

HARPER, E. A., Kansas City, Mo....1905

HATTON, T. CHALKLY, Consulting Engineer, Wilmington, Del....1903

HAUSSLING, JACOB, Mayor, Newark, N. J....1907

HAZLEHURST, JAMES NISBET, Consulting Engineer, 926-7 Candler Bldg., Atlanta, Ga. 1903

HENRY, P. W., Consulting Engineer, 90 West St., New York City....1906

HERRMAN, AUGUST, President, Waterworks Commissioners, Cincinnati Ohio 1894

HESTON, A. M., City Comptroller, Atlantic City, N. J....1908

HIGH, JOE B., City Engineer, Brunswick, Ga....1908

Membership Dates From

HILLYER, WILLIAM R., Asst. Commissioner of Public Works, Borough of Richmond, City of New York................................1908

HINDS, FRANK A., Consulting Engineer, Watertown, N. Y..........1906

HITTELL, JOHN B., Chief Engineer of Streets, 207 City Hall, Chicago, Ill. 1908

HOFFMANN, ROBERT, City Engineer, Cleveland, Ohio..................1908

HOLSTEIN, HERBERT A., City Engineer, Titusville, Pa..................1908

HORRIGAN, WILLIAM J., Asst. Eng., Street and Sewer Dept., Wilmington, Del. 1908

HOWARD, J. W., Consulting Engineer on Roads, Streets and Pavements, No. 1 Broadway, New York City...............................1901

HOWE, W. B., City Engineer, Concord, N. H..........................1895

HOWELL, ROBERT P., Town Engineer, Phillipsburg, N. J...............1908

HOWELL, WILLIAM A., Engineer, Street Dept., Newark, N. J..........1907

HUTCHEON, JAMES, City Engineer, Guelph, Ont.......................1899

IREDELL, GEORGE S., City Engineer, Austin, Texas.....................1908

JACOB, ELMER A., City Engineer, Provo, Utah........................1908

JOHNSON, EDW. J., Civil Engineer, 314 Lindelle Bldg., Spokane, Wash..1902

JONES, JOHN, Superintendent of Streets, Toronto, Ont................1896

JUDSON, WM. P., Consulting Engineer, Broadalbin, Fulton Co., N. Y...1902

KAY, PROF. EDGAR B., University of Alabama, Tuscaloosa, Ala........1906

KELSEY, LOUIS C., City Engineer, Salt Lake City, Utah...............1908

KENDRICK, JULIAN, Birmingham, Ala...............................1898

KER, NEWTON J., City Engineer, Ottawa, Can........................1902

KING, CLIFFORD M., Chief Engineer, Board of Public Service, Sandusky, Ohio 1908

KINGSLEY, EDGAR A., City Engineer and Supt., Department of Public Works, Little Rock, Ark.......................................1908

KUMMER, F. A., 26 South St., Baltimore, Md.........................1901

LAMBERT, GEORGE H., Commissioner, Board of Public Works, Newark, N. J. 1907

LEE, B. M., City Engineer, Asheville, N. C...........................1908

LEGGAT, ALEXANDER, P. O. Box 15, Butte, Mont.......................1908

LEONARD, C. E., City Engineer, Austin, Texas.........................1906

LEWIS, N. P., Chief Engineer, Board of Estimate and Apportionment, New York City...1895

LUDLOW, J. L., Consulting Engineer, Winston-Salem, N. C........1906

LUSTER, W. H., City Surveyor, Elizabeth, N. J.......................1905

Membership Dates From

McCartin, J. M., Superintendent of Streets, Birmingham, Ala........1900
McClure, W. F., City Engineer, Berkeley, Cal......................1908
McMath, Robert E., 327-328 Lincoln Trust Bldg., St. Louis, Mo.....1894
McMillan, Charles, City Clerk, Calgary, Canada...................1896
Maetzel, Henry, City Engineer, Columbus, Ohio....................1908
Marston, Frank L., Consulting Engineer, Stockton Springs, Me......1907
Mead, D. W., 605 First National Bank Bldg., Chicago, Ill...........1900
Meade, R. E., Consulting Engineer, 1520 Brown-Marx Bldg., Birmingham, Ala. 1906
Melvin, T. H., Sewer Dept., Wilmington, Del.......................1905
Meriwether, B. B., Care Birmingham Realty Co., Birmingham, Ala...1908
Minshall, Frederick, Consulting Engineer, Abbeville, S. C..........1905
Monie, John M., City Engineer, Bonne Terre, Mo...................1906
Morris, John B., City Hall, Newark, N. J..........................1908
Murphy, F. E., Supt. of Streets and Waterworks, Huntsville, Ala.....1906

Neves, William D., City Engineer, Greenville, S. C.................1908
Newton, Sam'l D., City Engineer, Knoxville, Tenn.................1908
Nicholson, M., City Engineer, Birmingham, Ala.....................1908
Noble, O. E., City Engineer, Hobart, Okla..........................1908
Norcross, P. H., 1623 Candler Bldg., Atlanta, Ga....................1908

Owen, James, Consulting Engineer, 196 Market St., Newark, N. J....1904
Owen, Kenneth D., Town Surveyor, Montclair, N. J..................1908

Parent, Arthur, Supt. City Lighting Dept., Montreal, Canada........1905
Parker, A. F., City Engineer, Ogden, Utah..........................1908
Parker, G. A., Superintendent of Parks, Hartford, Conn.............1902
Parkes, William J., City Engineer, Pine Bluff, Ark.................1906
Parmley, W. C., 78 Fifth Ave., New York City (after May 1, Cor. 17th St. and 4th Ave)..1908
Parsons, E. B., Consulting Engineer, Watertown, Wis...............1908
Pollock, Clarence D., Asst. Engineer, Bureau of Highways, Manhattan, N. Y..1902
Potter, W. G., Consulting Engineer, Greensboro ,N. C...............1905
Preston, J. M., City Engineer, Dallas, Texas.......................1908
Provost, A. J., Jr., Consulting Engineer, 39-41 W. 38th St., New York..1904
Putnam, J. E., Assistant City Engineer, Rochester, N. Y.............1907

Rankin, E. S., Engineer of Sewers and Drainage, Newark, N. J......1903
Reed, Alex., U. S. Wood Preserving Co., 29 Broadway, New York City 1901

Membership Dates From

REED, W. W., City Engineer, Green Bay, Wis........................1908

REIMER, WILLIAM H. V., City Engineer, East Orange, N. J........1903

REPPERT, CHARLES M., Asst. Engineer, Bureau of Construction, Dept. of Public Works, Pittsburg, Pa................................1908

REYNOLDS, A. M., Chief Engineer, Essex County Park Commission, Newark, N. J..1908

RIDGWAY, ROBERT, Department Engineer, Board of Water Supply, New York City, 236 Main St., Poughkeepsie, N. Y....................1908

RITER, GEORGE W., Salt Lake City, Utah.............................1905

ROGERS, D. D., City Engineer, Daytona, Fla..........................1908

RUST, CHARLES H., City Engineer, Toronto, Ont......................1898

RUTTAN, H. N., City Engineer, Winnipeg, Man......................1904

SCHMIDT, E. B., City Engineer, Terre Haute, Ind......................1908

SCHMITT, JACOB, Asst. Engineer, Bureau of Highways, Rm. 21, Municipal Bldg., Borough of Brooklyn, N. Y..........................1905

SHAND, GADSDEN E., Columbia, S. C.................................1908

SHANER, H. L., City Engineer, Lynchburg, Va........................1908

SHERIDAN, JOHN, C., Chief Engineer, Bureau of Highways, Borough of Brooklyn, N. Y..1905

SHERRERD, M. R., Chief Engineer, Dept. of Public Works, Newark, N. J..1896

SHIPMAN, CHARLES M., Gen'l Supt. of Works, Newark, N. J..........1905

SLATTERY, JOHN L., Secretary-Treasurer, St. Johns Municipal Council, St. Johns, Newfoundland 1901

SMITH, FRANCIS P., 24-26 E. 21st St., New York City................1908

SMITH, EUGENE, Civil Engineer and City Surveyor, Hoboken, N. J....1908

SMITH, JAMES J., City Engineer, Grand Forks, N. D.................1907

SOLOTAROFF, WILLIAM, Supt., Shade Tree Commission, East Orange, N. J...1906

SOUTHGATE, WILLIAM W., City Engineer, Nashville, Tenn............1908

SPRAGUE, NORMAN S., Supt., Bureau of Construction, Pittsburg, Pa....1908

STEWART, WILLIAM J., First Assistant City Engineer, Rochester, N. Y..1902

STOBAEUS, J. B., 160 Clifford St., Newark, N. J......................1899

STRACHAN, JOSEPH, Civil Engineer, 352 Putnam Ave., Brooklyn, N. Y..1905

SWEET, H. L., City Engineer, Neenah, Wis..........................1908

TALBOT, A. N., Professor of Municipal and Sanitary Engineering, University of Illinois, Urbana, Ill....................................1903

TAUBENHEIM, ULRICH E., Manager, City Waterworks, Archangel, Russia 1905

TAYLOR, ALEX. J., Engineer in Charge of Sewers, Wilmington, Del....1908

TAYLOR, CHARLES F., 900 Lewis Bldg., Pittsburg, Pa..................1908

Membership Dates From

THOMPSON, ATWELL, City Engineer, Jackson, Tenn....................1908
THOMPSON, A. D., 101 Y. M. C. A. Bldg., Peoria, Ill..................1895
THOMPSON, S. C., Prin. Asst. Engineer, Bureau of Highways, Borough of Bronx, New York..1904
TILLSON, GEORGE W., Chief Engineer, Bureau of Highways, Manhattan, N. Y..1896
TONSON, G. W., Director of Public Service, Toledo, Ohio..............1907
TRIBUS, LOUIS L., Consulting Engineer, 86 Warren St., New York City 1908

VINSON, J. S., Board of Public Works, Newark, N. J................1901

WADSWORTH, CHARLES S., 303 S. Lamar St., Dallas, Texas............1908
WARD, J. J., Member Board of Control, Toronto, Ont.................1908
WASHBURN, D. CUYLER, City Engineer, Aberdeen, S. D...............1908
WATSON, GEORGE L., 54 Baxter Bldg., Philadelphia, Pa............1908
WATSON, ROBERT M., Borough Engineer, Rutherford, N. J............1908
WEATHERFORD, J. H., City Engineer, Memphis, Tenn..................1908
WEISSLEDER, L. H., Consulting Engineer, with the Cincinnati and Suburban Bell Telephone Co., Cincinnati, Ohio.....................1906
WHEELER, HOLLAND, City Engineer, Lawrence, Kan...................1905
WHIPPLE, GEORGE C., Consulting Engineer and Sanitary Expert, 220 Broadway, New York..1905
WHITE, LINN., Chief Engineer, South Park Commissioners, Chicago, Ill. 1908
WHITNEY, HARRIE L., City Engineer, Beverly, Mass................1908
WILMOT, H. W., Expert Accountant, 54 William St., New York City..1904
WILSON, JOSEPH A., City Engineer, Lexington, Mo...................1908
WILSON L. N., JR., City Engineer, Johnson City, Tenn................1908
WILSON, W. M., City Engineer, Gadsden, Ala.........................1906
WINGFIELD, NISBET, City Engineer and Commissioner of Public Works, Augusta, Ga. 1906
WISE, W. W., Des Moines, Ia...1908
WRIGHT, FRANCIS H., Van Buren, Ark.................................1906

Associate Members

BANNEN, JAMES T., Secy., Kindling Machinery Co., Milwaukee, Wis..1908
A. L. BARBER ASPHALT CO., 17 Battery Place, New York City.........1906
BARRETT MANUFACTURING CO., 17 Battery Place, New York City.......1906
BLAIR, W. P., Secy., Nat'l Ass'n Paving Brick Mfgrs., Board of Trade Bldg., Indianapolis, Ind.......................................1907
RUDOLPH S. BLOME COMPANY, Bank Floor, Unity Bldg., Chicago, Ill..1908

Membership Dates From

BOYCE, C. F., Ass't Engineer, Decarie Incinerator Company, Minneapolis, Minn. 1908

BUFFALO STEAM ROLLER Co., Buffalo, N. Y. 1905

CANADIAN IRON & FOUNDRY Co., Ltd., Imperial Bank Bldg., Montreal, Canada 1905

CHERRY, WILLIAM I., President, United Paving Company, Atlantic City, N. J. 1908

CLEMENTS, L. L., U. S. Wood Preserving Co., 1007 Mercantile Library Bldg., Cincinnati, Ohio 1906

DAVIS, ROBERT K., Hammond Bldg., Detroit, Mich 1906

DECARIE, F. L., Chief Engineer, Decarie Mfg. Co., Minneapolis, Minn. .1905

DONELSON, JOHN E., Southern Bitulithic Paving Co., Birmingham, Ala. 1906

ENGSTFELD, G. C., Southern Paving & Construction Co., Birmingham, Ala. 1906

FARR, LESLIE B., President, Harlem Contracting Co., 2 Rector St., New York City 1908

GILLIGAN, HUGH F., 133 First St., Newark, N. J 1908

HARRIS, WALTER B., Gen'l Mgr., Warren Chemical & Mfg. Co., 17 Battery Place, New York City 1908

HOYT, RALPH, 11 Clinton St., Newark, N. J 1908

IMPERIAL ROAD Co., Times Bldg., New York City 1908

INGRAM, G. M., President, Southern Bitulithic Co., 602 First National Bank Bldg., Nashville, Tenn 1905

IRWIN, A. B., Sec. and Treas., Pacific Coast Pipe Co., 1551 Granville St., Vancouver, B. C 1905

JACKSON, NEWTON, Gen. Agt., U. S. Wood Preserving Co., Oak Lane, Philadelphia, Pa. 1908

JOHNSON, ALFRED H., Vice-Pres. and Gen. Mgr., Southern Bitulithic Co., Nashville, Tenn 1908

KETTLE RIVER QUARRIES Co., 954 Security Bank Bldg., Minneapolis, Minn. 1908

LASLEY, W. M., President, Southern Clay Mfg. Co., Chattanooga, Tenn. 1906

LOUD, HENRY S., Morristown, N. J 1908

Membership
Dates From

LOWERY, E. F., President, Reinforced Concrete Pipe Co., Jackson, Mich. 1906

LUTZ, G. H., Vice-President, Equitable Asphalt Maintenance Co., 1113 Commerce Bldg., Kansas City, Mo....1908

MCAVOY, JOHN C., Sec'y and Gen. Mgr., McAvoy Vit. Brick Co., 1345 Arch Street, Philadelphia, Pa....1905

MAGILL, CLAUDE A., Gen. Mgr., The Connecticut Hassam Paving Co., 902 Chapel St., New Haven, Conn....1908

MEAD, A. J., Reinforced Concrete Pipe Co., Jackson, Mich....1906

MEDILL, WILLIAM W., General Contractor, 50 Church St., New York City 1908

MERIWETHER, COLEMAN, President, Lock Joint Pipe Co., 165 Broadway, New York City....1908

MINER, H. A., Pres., Steel Protected Concrete Co., R. E. Trust Bldg., Philadelphia, Pa. 1908

MORRISON, JAMES, President, James Morrison Brass Mfg. Co., Toronto, Ont. 1905

MUNICIPAL JOURNAL AND ENGINEER, 239 W. 39th St., New York City..1908

MUSSEN, W. H. C., 299 St. James Street, Montreal, Can....1905

PARKER, R. H., United Paving Co., Atlantic City, N. J....1906

PITTSBURG FILTFR CO., Pittsburg, Pa....1905

POWER SPECIALTY CO., 111 Broadway, New York City....1908

REILLY, P. C., Indianapolis, Ind....1907

ROCK, J. C., The Savoy, 14th and Girard Sts., Washington, D. C......1906

SHREFFLER, JAMES M., President, Jersey Paving Corporation, Union Bldg., Newark, N. J....1908

STANDARD ASPHALT & RUBBER CO., 944 First Nat'l Bank Bldg., Chicago, Ill. 1908

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